Duramin-A300

With ecos Software

Manual No.: 15647001

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Duramin-A300
Instruction Manual

Always state *Serial No* and *Voltage/frequency* if you have technical questions or when ordering spare parts. You will find the Serial No. and Voltage on the type plate of the machine itself. We may also need the *Date* and *Article No* of the manual. This information is found on the front cover.

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Safety Precaution Sheet
To be read carefully before use

1. The operator(s) should be fully instructed in the use of the machine and its accessories and software according to the Instruction Manual.

2. The machine may only be operated by authorised persons. Protect the machine against unauthorised start-up.
The machine should not be operated by more than one operator at a time.

3. The machine must be placed on a safe and stable support table. All safety functions and guards of the machine must be in working order.

4. The machine may only be connected to an earthed (grounded) power outlet.

5. Prior to using the tester check to ensure that the test sample and indenter are properly secured.

6. Secure loose clothing.
Use of working gloves is recommended when handling samples that have chips, burrs or sharp edges.

7. Do not reach into the machine while it is running.

8. Adjustments to the machine should only be done when the unit is switched off and the main power is switched off.
The machine must be disconnected from the mains prior to any service.

9. Never leave the machine unattended while running. Before leaving the work area, switch off the machine.

The equipment should only be used for its intended purpose and as detailed in the Instruction Manual.

The equipment is designed for use with accessories supplied by Struers. If subjected to misuse, improper installation, alteration, neglect, accident or improper repair, Struers will accept no responsibility for damage(s) to the user or the equipment.

Dismantling of any part of the equipment, during service or repair, should always be performed by a qualified technician (electromechanical, electronic, mechanical, pneumatic, etc.)

Disposal

Equipment marked with a WEEE symbol contain electrical and electronic components and must not be disposed of as general waste.
Please contact your local authorities for information on the correct method of disposal in accordance with national legislation.

Instruction Manual

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1. Getting Started

Model Configurations

The hardware configuration of the Duramin-A300 hardness tester depends on which model was ordered. The following hardware configurations are offered as standard:

	Duramin Models				
Model	**A**	**B**	**C**	**D**	**E**
Manual cross slide	Yes	Yes	No	No	No
Motorised stage	No	No	Yes	Yes	Yes
Lens swivel system	Standard on all models				
Automatic turret	Optional on all models				
Overview camera	No	No	No	Yes	Yes
PC and monitor	Necessary for operation				

For more information on configurations, technical data and software modules please refer to chapter 20 *Technical Data*.

Checking the Contents

In the packaging box you should find the following items:

Duramin-A300 hardness tester with ordered indenter and lenses installed.
Cross slide or or x-y stage
Cable for power supply (European standard or US)
1 Cable for serial connection to PC
1 Cable for serial connection of automatic turret (optional)
1 USB 2.0 Cable
1 USB 2.0 Cable type A/m –A/m for overview camera (optional)
1 **ecos** CD including:
- Software (installed if PC is supplied)
- Machine specific data
- Instruction Manual
- Installation Guide
- Calibration certificate for supplied indenters (pdf)

1 USB Dongle
1 Hook wrench for mounting/exchanging objective lens
1 Adjustment ring for mounting of an additional indenter (only with automatic turret)
1 Allen key for changing indenter
1 Allen key for adjusting the objective lens
1 Fuse for 110V operation (1A)
Calibration Report from the manufacturer Emcotest
Calibration certificates on indenters supplied with the tester

Optional Accessories

Interchangeable lenses
Interchangeable indenters
Sample holders
Dust protection

Installation Site

The location where the tester is to be installed should be adequately clean, free from dust, fumes and other sources of contamination. This will lead to longer and more stable performance of the machine, PC and components.

Recommended operating environment:

Room temperature: 23° C +/- 5° C (73,4° F)
Relative humidity: 40-70%
When selecting the site for the installation, make sure there is adequate and proper lightning.
The work station can be designed for operation either while standing or seated. Select the height of the table so that the PC and screen placement allow for comfortable operation.
Always observe the local guidelines regarding work with PC's.

Placing Duramin-A300

Duramin-A300 should be placed on as horizontal as possible surface to ensure steady position. Fine levelling can be accomplished with the adjustable feet on the machine.
A special base or table is not necessary; however care should be taken to avoid exposing the machine to vibrations. Excessive vibrations can negatively influence the operation and accuracy of the machine.
The table should be able to carry a weight of min. 60 kg.

The hardness tester should be placed on its own table if possible, separate from the PC. This will reduce vibrations which can affect the magnified real-time picture displayed on the monitor.

Transportation lock

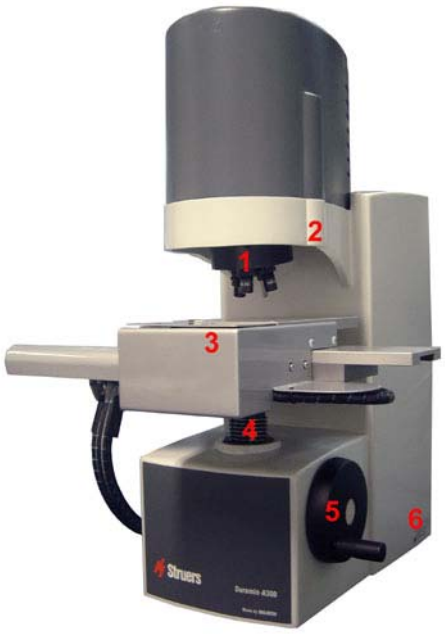
When transporting the machine please make sure that:

- The measuring unit with the lenses and indenter is in its lowest position
- The indenter is swivelled in
- The sample stage is moved up to clamp the enclosed rubber jaw between the stage and the indenter.

Getting Acquainted with Duramin-A300

Take a moment to familiarise yourself with the location and names of the Duramin-A300 components.

Duramin-A300 Front View



1. Swivel head or automatic turret (optional)
2. Overview camera
3. Sample stage
4. Test spindle
5. Test spindle hand wheel
6. Serial number plate

Swivel Head or Turret

The swivel head is the mechanism where the indenter and up to two objective lenses are attached. It enables the automatic swivel-in and/or –out of the lens system.
The automatic turret (optional) has four positions and can hold 1 indenter and three objective lenses, or two indenters and two objective lenses. Swivel-in and –out of the correct lens is performed automatically.
During the hardness test cycle, indenter is pressed downward into the sample by means of the DC motor via a closed loop with measuring and control electronics. The automatic evaluation determines the hardness value.

> ***NOTE***
> When mounting an additional indenter (e.g. Knoop) in the automatic turret, the enclosed adjustment ring is used to align the indentation in the middle of the screen. The additional indenter can be mounted in any position in the turret with the adjustment ring. The alignment is achieved by turning the Allen screws on the side.

Overview Camera

The overview camera included in Duramin-A300 models D and E (also referred to as second camera) is a low magnification camera with a field of view of approx. 50x40 mm. It facilitates the selection of starting test points.

Cross Slide or XY-Stage

Duramin-A300 models A and B are supplied with a manually operated cross slide. Duramin-A300 models C, D and E are supplied with a stepper motor controlled XY-stage. The motorized stage is controlled exclusively through the software on the PC.
Samples of appropriate configuration can be placed directly on the stage. If series of measurements are to be made on the same sample, it is recommended that the entire sample surface is kept plane parallel to the sample stage as this will provide shorter process times.
Sample holders are available for levelling samples to ensure plane parallel test surfaces and fixation of irregular samples.
The sample stage has threaded holes to fix sample holders.

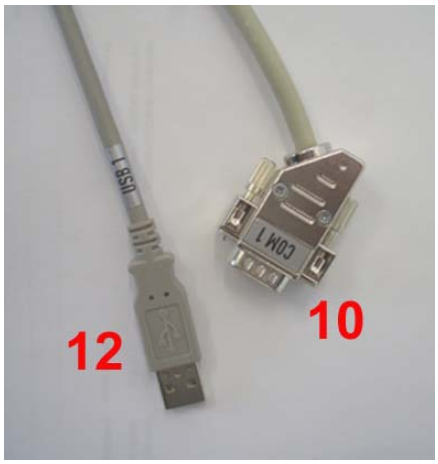
Test Spindle

The test spindle serves as the axis upon which the sample stage is mounted. The vertical position of the test spindle is adjusted with the hand wheel.

Duramin-A300 Rear View

7. Main switch and mains socket
8. Fuse plug
9. Sockets for connection of motorized stage
10. Socket for serial connection to PC (COM1)
11. Socket for connection of automatic turret (if turret is installed) or return signal for manual XY-slide.
12. USB port for connection of evaluation camera (USB2)
13. USB port for connection of optional overview camera (USB1)

PC and cable connections:



Connections

Always remember to switch the power off on both the hardness tester and the PC when installing or disconnecting the electrical equipment!

DANGER!
The machine must be earthed

IMPORTANT
Check that the mains voltage corresponds to the voltage stated on the type plate on the side of the machine.

Power Supply

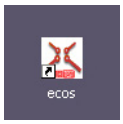
- First check that the fuse plug is turned to set the correct voltage. The arrow on the fuse plug should point towards the mark on the plug housing.
- If not, pull out the fuse plug, turn it and reinsert into the plug housing.
- Select the appropriate mains cable and connect it into the mains plug. The machine should only be connected to an earthed outlet.

Connecting Duramin-A300 to the PC

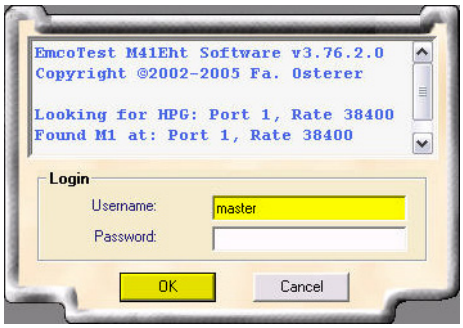
- The second plug (10) is connected to the serial port 1 on the PC (COM 1).
- If the tester is equipped with a motorized XY stage, the two cables mounted on the stage are connected to the two lower plugs (9).
- If the tester is equipped with an automatic turret, the plug (11) at the top of the tester is connected to the serial port 2 on the PC. This connection is used to control the automatic turret (optional).
- The USB connection (13) will transmit the real-time image from the overview camera.
- The USB connection (12) will transmit the real-time image from the evaluation camera.

NOTE:
To maintain a stable operation, do not install additional software or components on the PC.
Connect the PC to a stable and uninterrupted power supply.

Initial Start-up



- Plug in the Duramin-A300 and switch on the tester at the main switch located on the back of the machine.
- Turn on the PC. Windows® should run.
- Start the **ecos** software by double-clicking the **ecos** icon on the desktop.
  If **ecos** has not yet been installed, please go to the Software Installation section on the **ecos** CD before proceeding.
- Enter the username **master**. Do not enter any password. Click **OK** to launch the program.

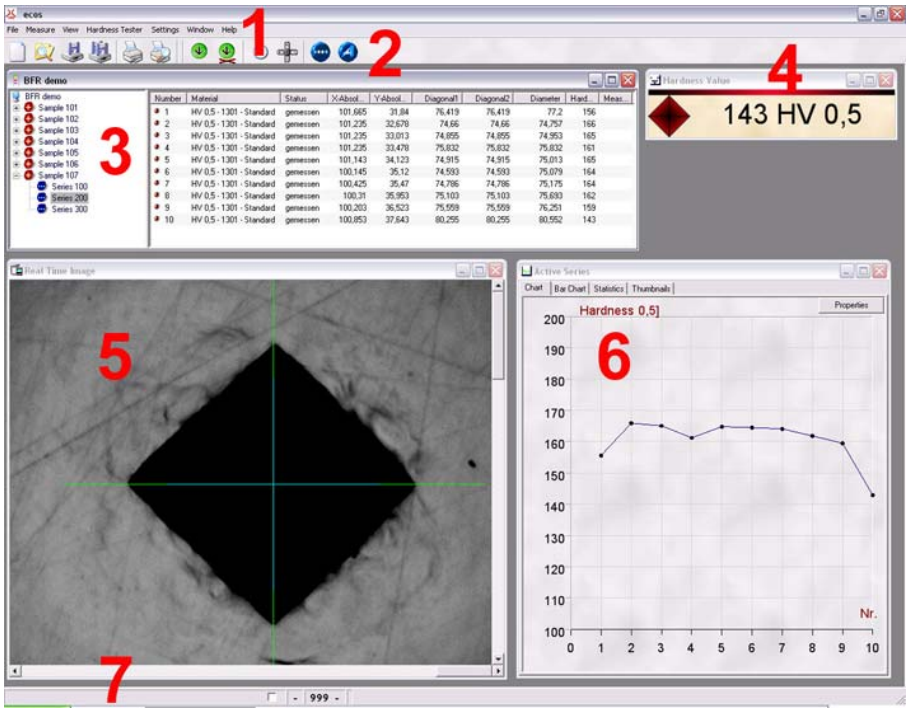


The instructions described in this manual provide that the user is logged in as master unless otherwise stated.
To learn more about user levels, please go to chapter 10 *Managing User Levels*.

NOTE
If the machine is not used for a longer period of time:
Clean the machine thoroughly.
Apply a light coating of oil to the stainless steel surfaces.
Protect the machine from unauthorised usage.
Place a dust cover on the machine.

Getting Acquainted with the ecos Software

The layout of the screen and types of operations available in the **ecos** software follows the conventions and standards for Windows® applications.



ecos Screen Layout

1. Menu bar
2. Tool bar
3. Test Specification window listing all folders, samples, test series and measurements.
4. Hardness value of the indent measured last and test method.
5. Real-time image of the sample surface / indent.
6. Active Series window with graphical presentation of the measured series.
7. Status bar with user status and error messages.

The layout of the screen can be customized as with most Windows® applications.
Various windows can be displayed or hidden and the size and location of each window can be adjusted to suite the individual user.

The screen settings last selected are stored automatically when the program is exited and loaded again when the software is run.

In each window, various context menus can be called up by clicking the right mouse button. The content and availability of these menus depend on which user level the software is operating in.

Menu Bar

On the menu bar, menus and submenus give access to all functions of the software. The menus available are restricted by the user level and by the hardware and software modules installed.

Toolbar

The toolbar is located directly below the menu bar. By clicking the various icons, the most common commands can be called up directly.

Test Specification

The structure and function of this window is similar to Windows® Explorer. This is the filing system where all the data from indents that have been measured and scheduled tests to be performed are stored.
The left side of the window is a tree view with four possible types of entries. When an item in the tree is left mouse clicked, the right window displays a list of all the items in the next level.
A right mouse click of the item in the left window invokes a context menu listing operations available to that item.

The four possible content types in the left window are:

Main Directory	The *Main Directory* stores all folders and samples.
Folder	*Folders* are not mandatory but are useful for structuring of samples. *Folders* can contain subfolders and samples.
Sample	The *Sample* window is where default settings for all test series the sample will contain are set (lens, load, test method, statistical limits etc.).
Series	The *Series* window is where all information about individual measurements is stored (number, XY coordinates, hardness reading etc.). A series must be highlighted to swivel between objective lens and indenter and to run a test.

Real-time Image

This window shows the real-time image of the sample surface through the high magnification lenses. The camera is mounted directly above the indenter. The image displayed in this window is captured for automatic reading of the indentations.

To the right of the lens swivel system or turret, an overview camera is mounted (option). This camera has a low magnification of approx. 4x. The image from the camera is captured and can be displayed on a test report if the camera was used to set test points or traverse starting points.

Active Series

The *Active Series* window gives a graphical representation of a series of indentations. The graph updates after each indentation when running an automated series.
The graph will plot the number of indentations (X) versus hardness (Y).
The *Active Series* window also gives access to statistical evaluation and thumbnails of images.
Previously run series can be displayed by highlighting the series in the *Test Specification* window.

Measurement Value

This window displays information about an individual indent. The window shows information regarding the most recently measured indent.
The information includes:

- Icon representing indentation type
- Test method and load
- Hardness value

Status Bar

The status bar is located at the bottom of the main screen.
Information displayed in the status bar includes:

- Current user level
- Error messages

2. Operation Guidelines

Mouse and Function Keys

The software is operated through the mouse and keyboard.
Left mouse click will:

- Activate menus from the menu bar
- Select commands from the called up menu (opening dialog boxes)
- Select commands via the icons on the toolbar menu
- Shift and turn measurement lines when manually measuring an indentation
- Set test points and place test points patterns

Right mouse click will:

- Open context menus. Context menus are submenus that contain further operations which correspond to the activated object.

Conventions Used

In this manual, the following conventions are used:

A bullet ■ indicates a step in a process.

Menu|*Item* indicates a menu item on the ecos menu bar. For example, “Click *File*|*New Directory*” means click on “File” in the menu bar, and then click on “New Directory” in the File menu.

Italics indicate the name of a dialog box, a dialog box tab or a menu or submenu item.

Bold indicates an object on a dialog box such as a button. For example, “Click **OK**” means click the OK button.

“Quoted text” indicates information that is to be typed into the system exactly as shown.

<Key> indicates a key to press in order to perform an action.

NOTE:
The colours of the software screens of Windows Vista may differ slightly to the ones shown in this manual.

Shortcut Keys Overview

Toolbar Icon	Shortcut Key	Command
		New Directory
		Open Directory
		Save Directory
		Save All open Directories
	ctrl D	Print
		Print Preview
	f12	Export Data
	f1	Help
	ctrl M	Open Surface Settings for method
	f2	Single Measurement
	f3	Single Measurement without penetration
	f6	Series Measurement
	f4	Length Measurement
	f9	Open Automatic Measurement
	f10	Display Real-time Image
	f11	Display Overview Image
	f5	Open Focus Control
	f7	Swivel-in Lens
	f8	Swivel-out Lens
	ctrl A	Move XY-Stage

Operating the Lens System

The lens system consist of the interchangeable lenses, LED through lens lightning and the CMOS camera. This system allows for the real-time display of the indent on the PC monitor for automatic or manual measurement.
Each lens is factory calibrated and a magnification factor is determined. This factor is used by the software to ensure proper calibration.

Lens Magnifications

The following objective lenses are available for Duramin-A300:

Magnification	Purchase Code	Total mag. Factor	Field of View (mm)	Lens ID
3x	HOFRI	180x	1.16 x 0.92	0G
5x	HOFIV	240x	0.90 x 0.72	1G
10x	HOTEN	360x	0.58 x 0.46	2G
20x	HOTWE	600x	0.35 x 0.28	3G
40x	HOFOT	1200x	0.18 x 0.14	4G
80x	HOATI	2400x	0.09 x 0.07	5G

The total magnification factor and field of view values are approximate values.

Swivelling Lens and Indenter

Swivelling between objective lens and indenter is controlled by ecos:

- To swivel in the lens, press the <F7> function key or select *Hardness Tester*|*Swivel in Lens* in the menu.
- To swivel out the lens, press the <F8> function key or select *Hardness Tester*|*Swivel out Lens* in the menu.

NOTE
A test series has to be selected in order to swivel in the lens, otherwise the system will not be able to determine, which lens to swivel in.

CAUTION
Make sure that the swivel movement is not blocked (e.g. by sample or sample holder) during swivel-in / swivel-out operation to prevent collision with and damage to the indenter or lenses.

Viewing Real-time Image

To view the real time image of the objective lens:

- Press the <F10> function key or select *View*|*Real Time Image* to open the real-time image.

Adjusting Lens Focus

On all Duramin-A300 models, fine focussing of the sample surface is controlled via the **ecos** software.

Moving the Sample Stage

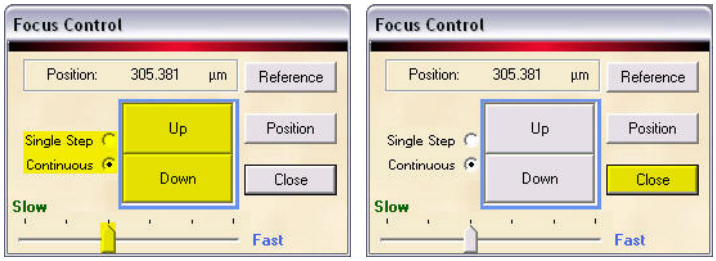
When positioning the sample, raise and lower the sample stage with the hand wheel to bring the sample into focus.
To bring the sample into focus:

- Select or create a measurement series.
- Lower the sample stage using the hand wheel.
- Place the test sample on the sample stage.
- Swivel in the lens system by pressing the <F7> function key or by selecting *Hardness Tester|Swivel in Lens* in the menu.
- Display the real-time image of the camera by pressing the <F10> function key or by selecting *View|Real Time Image*.
- Raise the sample stage using the hand wheel until a sharp image of the test sample surface is displayed on the screen.

Fine Focussing the Lens

With a sharp image of the test sample surface on the screen (as described above) fine focus the lens as follows:
To fine focus the lens:

- Press the **Focus** button on the tool bar, or press the <F5> function key, or select *Hardness Tester|Focus* in the menu. The *Focus Control* window opens.
- Click **Single Step** to move the lens in increments of approx. 1 µm and click **Up** or **Down** to fine focus your image.
- Alternatively click **Continuous** to move the lens as the **Up** or **Down** buttons are clicked and then held down.
- Move the slider between **Slow** and **Fast** to set the focussing speed.
- Click **Close** to close the *Focus Control* window.



NOTE
The measurement result is not affected if the image is not completely sharp. Due to the closed-loop technology, the hardness tester registers when the indenter penetrates the sample surface and uses a known displacement to focus before image analysis.

NOTE
During focussing, a possible eccentricity of the indent (ie. the distance from the indent to the centre of the Field of View) is automatically detected and saved as a correction offset value.
This is important as it affects the positioning accuracy.
When adjusting the position of the indent in the Field of View (for instance by physically adjusting the screws on the objective lenses) it is necessary to re-adjust and save the focus setting.

Installing the Lenses

Lenses ordered together with the Duramin-A300 will be factory mounted.
To exchange a lens:

- Swivel out the lens system by pressing the <F8> key.
- Switch off the main power on Duramin-A300.
- To remove a lens, manually unscrew the lens from the slide fixture or turret and store it in the supplied plastic storage case.
- Take the new lens from the plastic storage case and manually screw it into the open position on the slide or turret.
- Tighten the lens with moderate force using the enclosed hook wrench.

CAUTION
Before removing or installing indenters or objective lenses, switch off the main power on the Duramin-A300. Changing indenters or lenses with the power switched on may trip the collision sensor and disable stage and swivel head or turret movement.

IMPORTANT
Always keep spare lenses in the plastic case supplied to avoid damage.
Care should be taken to ensure cleanliness of the optics.
Only handle lenses by the knurled ring; do not touch the lens glass.

IMPORTANT
Only lenses specifically ordered for the Duramin-A300 should be used.
Always make sure that the lens that is used for test analysis is the lens specified in the software for the respective measurement.

Adjusting the Lenses

If after running a test cycle the indent is not completely inside the real-time image displayed on the PC monitor, the lens position may need to be corrected.

IMPORTANT
Check to ensure the test sample is secure, the surface is flat and the machine is not being influenced by vibrations as these conditions can lead to misplacement of the indent.
Before adjusting the lenses, run several test cycles on a standard test block to verify the misalignment.

To adjust the lenses on the swivel head:

- Press <F7> to swivel the lens in.
- Display the real-time image on the PC monitor by pressing the <F10> key.
- Verify that the lens slide fixture is fully seated in position.
- The position of the lens axis can be corrected by slight adjustment to the four Allen set screws on the lens.
- When adjusting a set screw on the lens, remember to loosen the set screw on the opposite side.
- The corrected position can be monitored on the real-time image on the PC monitor.
- When the adjustment is completed, moderately tighten all four set screws.

> ***NOTE***
> The adjustment screws on the slide fixture of the swivel body are not used for the adjustment of the lenses. The slide guides and stops were adjusted at the factory and should not be changed.

Indenters

An indenter ordered together with the Duramin-A300 will be factory mounted.

Installing the Indenter

To install or exchange an indenter:

- Lower the sample stage to the lowest position using the hand wheel.
- Press <F8> to swivel in the indenter to be exchanged.
- Switch off the main power on Duramin-A300.
- To remove an indenter, loosen the screw with the supplied Allen key, and remove the indenter.
- Insert the new indenter in the empty slot on the swivel head.
- Re-tighten the screw to secure the indenter in position.

> ***CAUTION***
> Before removing or installing indenters or objective lenses, switch off the main power on the Duramin-A300. Changing indenters or lenses with the power switched on may trip the collision sensor and disable stage and swivel head or turret movement.

> ***IMPORTANT***
> Always keep spare indenters in the plastic case supplied to avoid damage.

Operating the Sample Stage

On all Duramin-A300 the sample is moved up and down (Z-axis) by turning the spindle hand wheel.

Manual Cross Slide

If your hardness tester is equipped with a manual cross slide, X and Y movement is done by turning the X and Y dials and the following instructions are not relevant.

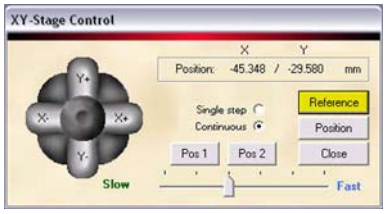
Motorised XY-Stage

If your hardness tester is equipped with a motorised XY-stage, X and Y movement is controlled via the ecos software.

Referencing the Position of the Stage

For the XY-stage to recognise its position, it is necessary to reference it every time the hardness tester has been turned off.
To reference the position of the XY-Stage:

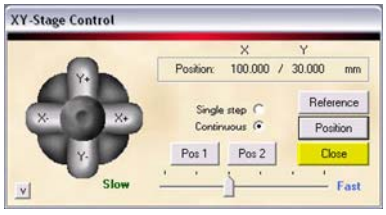
- Click the **XY-Stage Control** button on the tool bar, or press the <Ctrl>+<A> keys, or select *Hardness Tester|Move XY-Stage* in the menu.
- The *XY-Stage Control* window opens. Click the **Reference** button, and the XY-stage will move to its reference position (X=0, Y=0).



Moving the XY-Stage to Position Coordinates

To move the XY-stage:

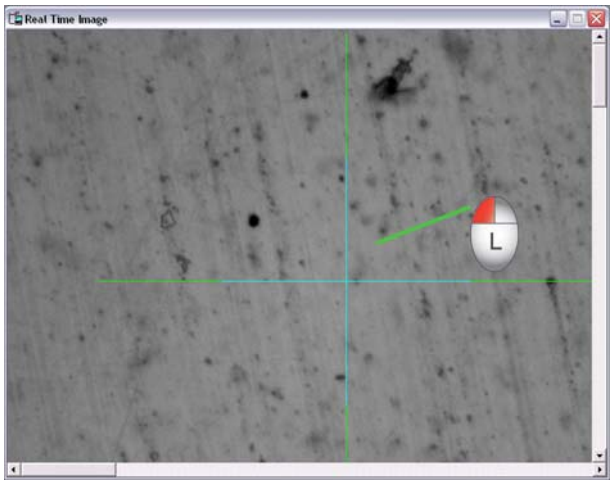
- Open the *XY-Stage Control* window as described above.
- Click the **Position** button to open the *Position* window.
- Enter the desired position and click **OK**. The XY-stage will move to the entered position.
- Click **Close** to close the *XY-Stage Control* window.



Moving the XY-Stage in Real Time View

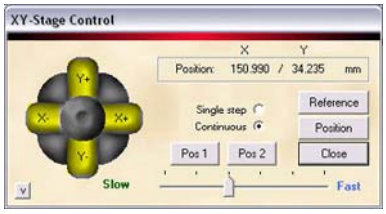
If the position coordinates are not known, or need to be finely positioned, the XY-stage can be moved while viewing the real time image:

- Open the real-time image by pressing <F10>.
- Click with the mouse in the image to move this point to the centre of the image (XY-stage will move).
- Alternatively, mouse click in the image and drag a line in the direction of the area of interest (XY-stage moves in the opposite direction).



HINT
The length of the line dragged with a mouse click in the real-time image to move the XY-stage, will determine the speed with which the stage will move.

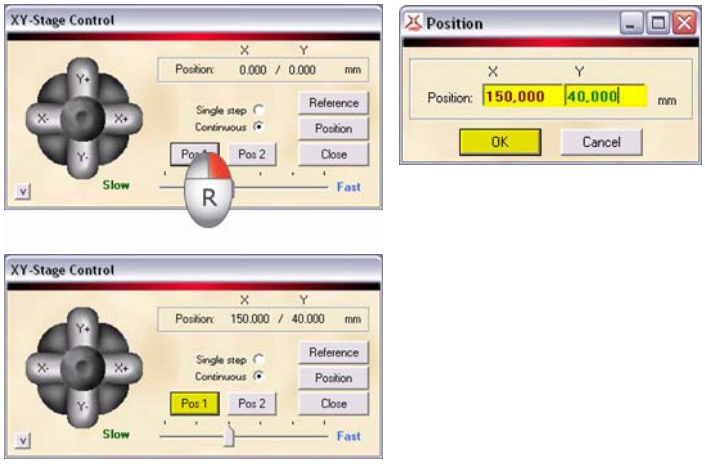
- Alternatively, click the **XY-Stage Control** button on the tool bar, to open the *XY-Stage Control* window and click the **joystick** to move the XY-stage.



Saving XY-Stage Positions

To move the XY-Stage to specific positions, two positions can be stored for fast selection.
To store a XY-stage position:

- Open the *XY-Stage Control* window by clicking the **XY-Stage Control** button on the tool bar or the function keys <Ctrl>+<A>.
- Right mouse click on the **Pos 1** (or **Pos 2**) button to open the *Position* window.
- Enter the desired position and click **OK**. The XY-stage position is stored.
- To move the XY-Stage to the stored position, simply click **Pos 1** (or **Pos 2**).



3. Preparing Measurements

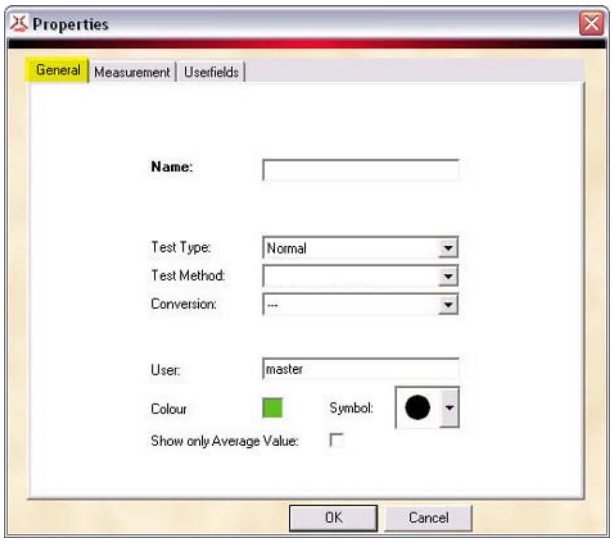
Before starting to make indentations and measurements, a file structure must be defined to manage the data.
Similar to Windows® explorer ecos uses a tree structure with directories, folders, samples and test series.

Properties

All directories, folders, samples and test series have properties registered to define your work, including test method. Properties are inherited from a higher level in the tree hierarchy but can always be changed at a lower level.

Before creating the tree structure, take a moment to familiarize yourself with the properties:

General Properties



Under *General* properties, enter and select the following:

- Enter a **Name** for the directory, folder, sample or test series.
- Enter the type of measurement to be performed.
  Normal is for general hardness test runs.
  CHD (Eht), Nht and Rht are case depth test procedures according to specific standards.
  Jominy is a test procedure for steel according to a specific standard.

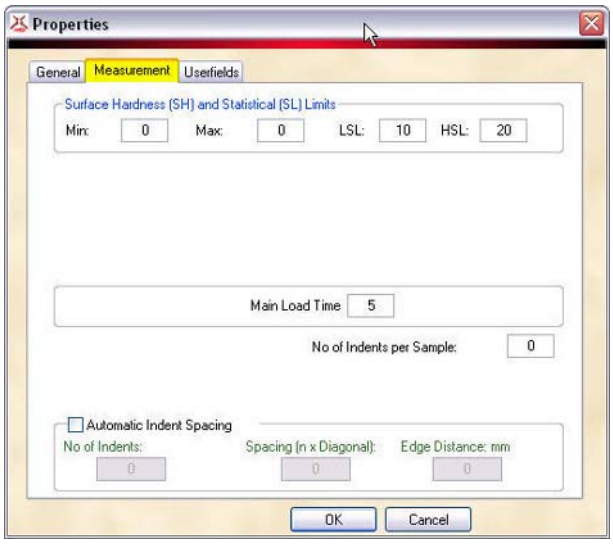
PRECONDITIONS
Case depth and Jominy procedures will only be selectable if the specific ecos modules are installed.

- Select a **Test Method**.
- Select **Conversion**, to have measurement values read out in another scale than the test method.

Each sample is designated a colour and a symbol which facilitates identification and comparison.

- To change the **Colour**, click on the coloured box and select a colour in the colour palette.
- To change the **Symbol**, click the drop down list and select a symbol.
- Select **Show only average value** for the average value of a series of indentations and not the hardness value of each indentation measured.

Measurement Properties



Under *Measurement* properties, various limits can be set, depending on the test type chosen above.
If Normal test type was selected under *General* properties, surface hardness and statistical limits for the test series can be set.

- **Surface Hardness Limits** will appear on the graphs.
- **Statistical Limits** will determine whether a measurement value is included in the statistical evaluations or not.

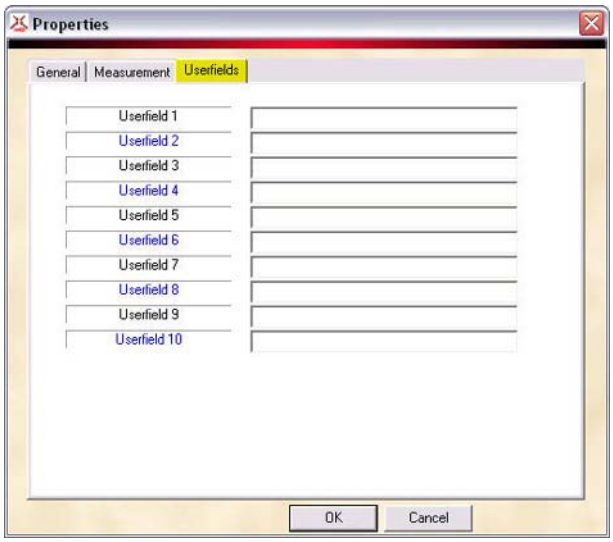
NOTE
The limits are selected in the same hardness scale as the test method chosen e.g. HV for Vickers test methods.

NOTE
For more information on statistics, please refer to chapter 11 *Statistics*. Hardness limit settings for case hardness depth test runs are described in chapter 6 *Measuring Case Depth*.

Other properties that can be selected under *Measurement* properties are:

- **Main Load Time** (in seconds)
- **Pre-load Time** (in seconds) when performing Superficial Rockwell Tests

Userfields



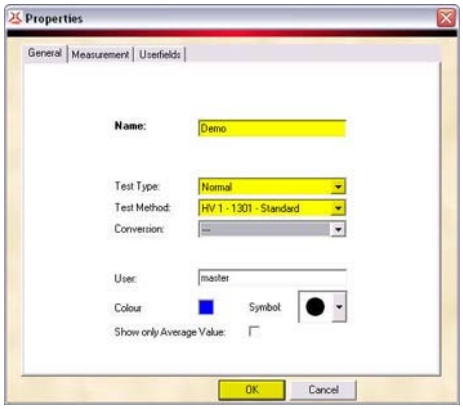
Custom-defined information and notes can be entered under *Userfields*. The Userfields are included in the printing reports.

> ***NOTE***
> The labels and number of Userfields are defined under settings. Please refer to the chapter 14 *General Settings* to learn more about Userfields.

Creating a Directory

Start by creating a main directory for folders, samples and measurement series:

- Click the **Create New Directory** button on the toolbar, or select *File*|*New Directory*.
- In the *Properties* window, enter a name for the directory.
- Select properties as described above.
- Click **OK** to create the directory.



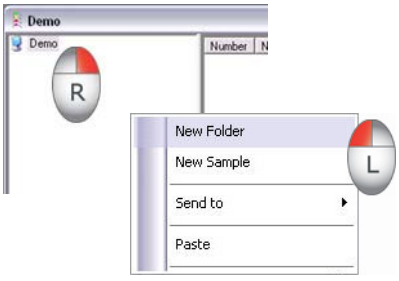
Deleting a Directory

The name of the directory cannot be changed once the directory has been created. Further, directories cannot be deleted within the **ecos** software.
To delete a directory, use Windows® explorer to find and delete the directory file.

> ***CAUTION***
> Deletion of a directory file will delete all folders, samples and test series within this directory, and they cannot be restored.

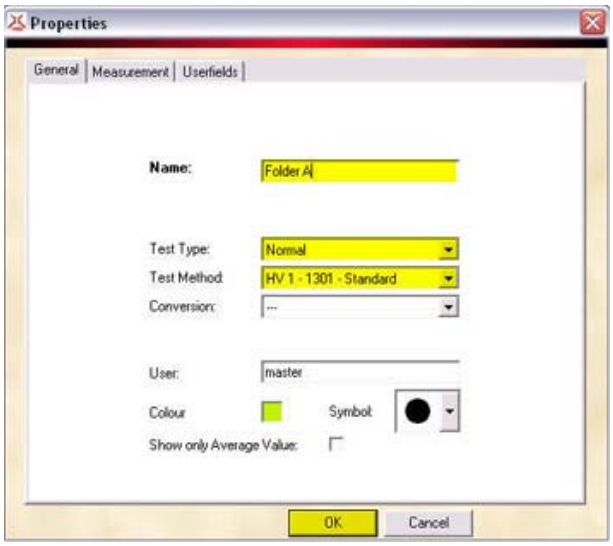
Creating a Folder

Folders can contain subfolders and samples. Folders are not mandatory as samples can be created directly in the main directory. However, folders and subfolders may help in structuring samples and measurement series.

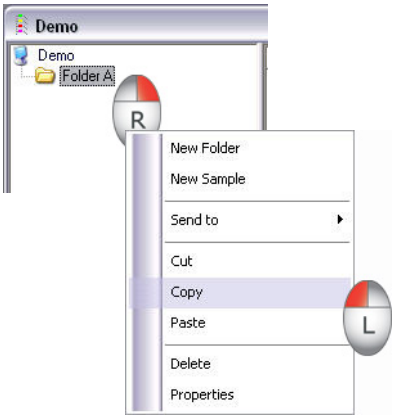


To create a new folder:

- Select the directory, folder or sample where the new folder is to be created.
- Right mouse click to open the context menu.
- Select *New Folder*.
- Enter a name for the folder.
  The new folder automatically inherits the properties from the level above. If required, change the properties as described above.
- Click **OK** to create the folder.

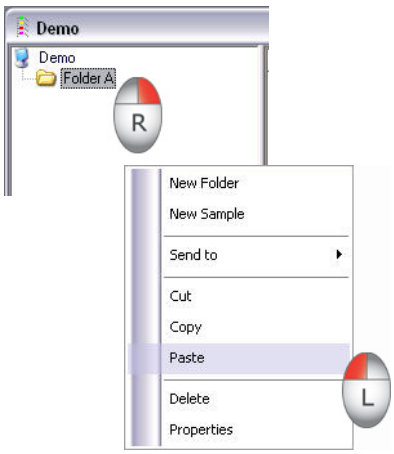


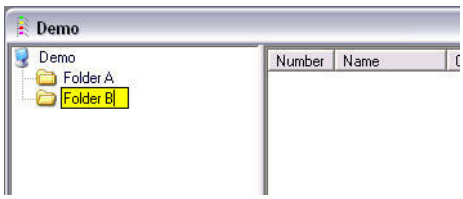
Copying and Pasting Folders



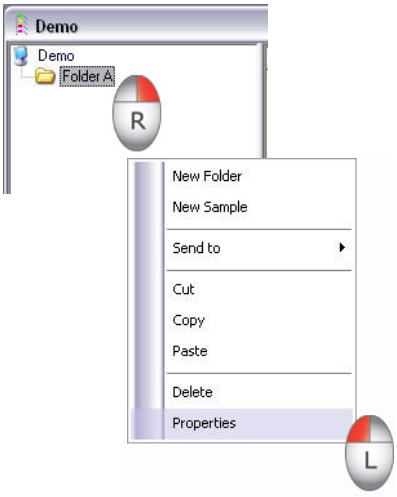
Folders including the properties set can be copied:

- Select the folder to be copied.
- Right mouse click to open the context menu.
- Select *Copy*.
- Select the directory, folder or sample to paste the copied folder.
- Right mouse click to open the context menu.
- Select *Paste*.
- Enter a name for the folder.
  The new folder automatically inherits the properties from the folder copied. If required, change the properties as described above.





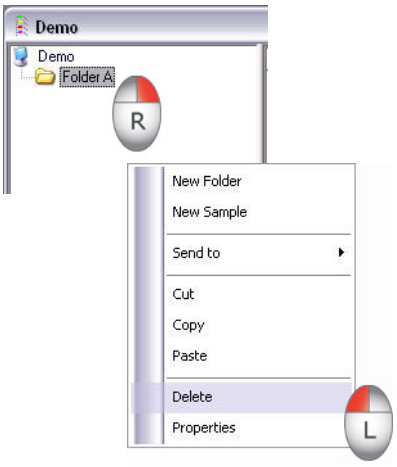
Editing Folder Properties



The properties of a folder can be edited once created. However, modifications will affect all underlying folders, samples and test series.
To edit the folder properties:

- Select the folder to be edited.
- Right mouse click to open the context menu.
- Select *Properties*.
- Edit the properties in the *Properties* window.
- Click **OK** to save the modified properties.

Deleting Folders



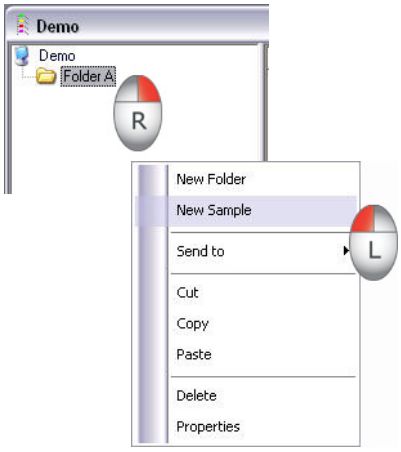
To delete a folder and all underlying samples and test series:

- Select the folder to be deleted.
- Right mouse click to open the context menu.
- Select *Delete*.

CAUTION
Deletion of a folder will delete all samples and test series within this folder.

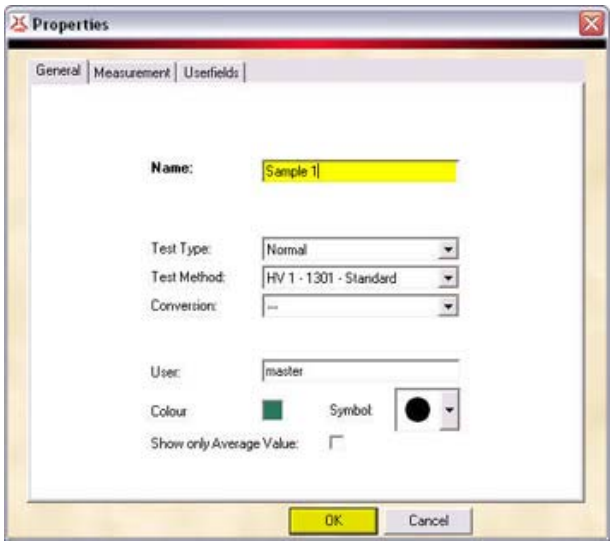
Creating a Sample

A sample can contain one or more test series.
Unlike folders, samples are mandatory.

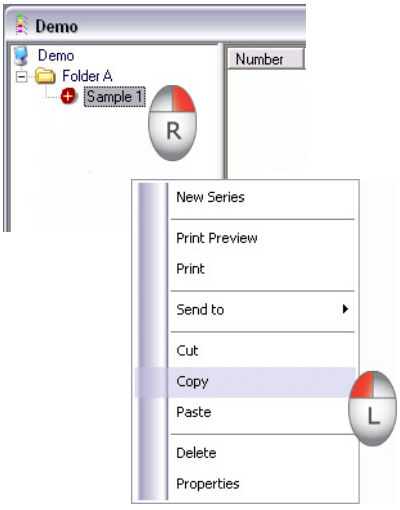


To create a sample:

- Select the directory or folder where the sample is to be created.
- Right mouse click to open the context menu.
- Select *New Sample*.
- Enter a name for the sample.
  The new sample automatically inherits the properties from the level above. If required, change the properties as described above.
- Click **OK** to create the sample.



Copying and Pasting Samples



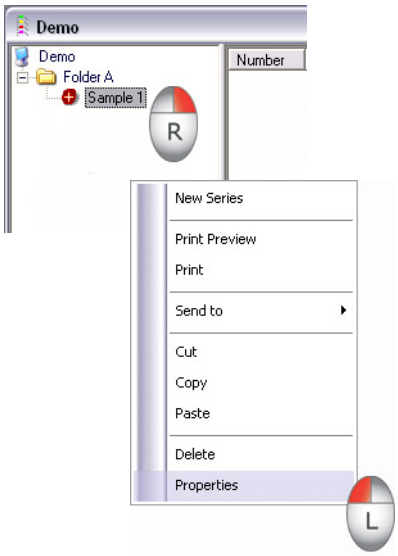
Samples including the properties set can be copied and pasted:

- Select the sample to be copied.
- Right mouse click to open the context menu.
- Select *Copy*.
- Select the directory or folder where the copied sample is to be pasted.
- Right mouse click to open the context menu.
- Select *Paste*.
- Enter a name for the sample.
  The new sample automatically inherits the properties from the sample copied. If required, change the properties as described above.

HINT
If a sample containing test series is copied, all test series will also be copied but without any measurement values.
The copy and paste method is a fast way of creating samples where the same test series with the same test point patterns is to be performed on several samples.

Editing Sample Properties

The properties of a sample can be edited once created.



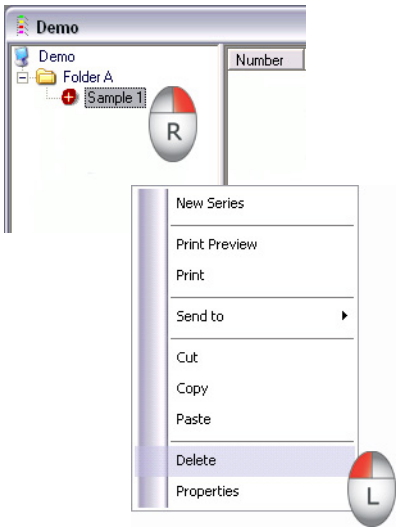
To edit the sample properties:

- Select the sample to be edited.
- Right mouse click to open the context menu.
- Select *Properties*.
- Edit the properties in the *Properties* window.
- Click **OK** to save the modified properties.
- Click **Yes** to apply the properties to all test series related to this sample, or **No** to edit the properties for the sample only.

Deleting Samples

To delete a sample and all underlying test series:

- Select the sample to be deleted.
- Right mouse click to open the context menu.
- Select *Delete*.

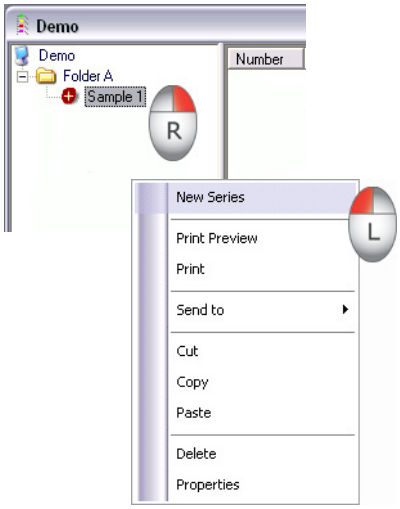


CAUTION
Deletion of a sample will delete all test series connected to this sample.

Creating a Test Series

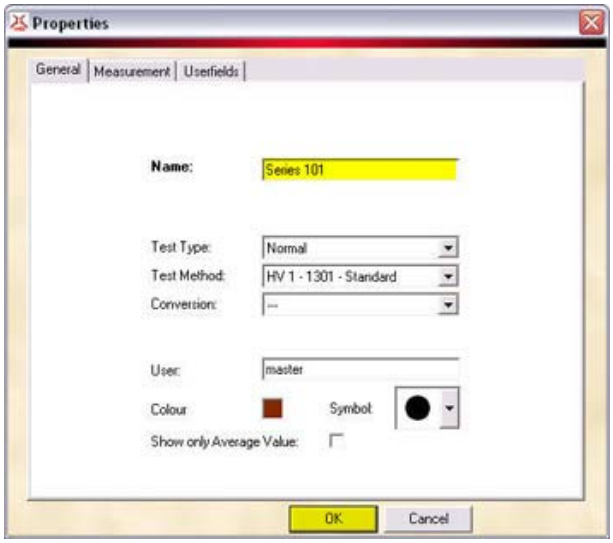
A sample can contain one or more test series. A test series can be a single measurement or a series of measurements. All measurement data, images etc. are related to test series.

New Test Series

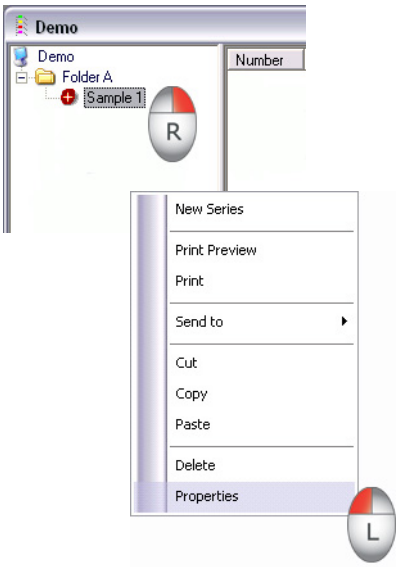


To create a test series:

- Select the sample in which the test series is to be created.
- Right mouse click to open the context menu.
- Select *New Series*.
- Enter a name for the test series.
- The new test series automatically inherits the properties from the level above. If required, change the properties as described above.
- Click **OK** to create the test series.

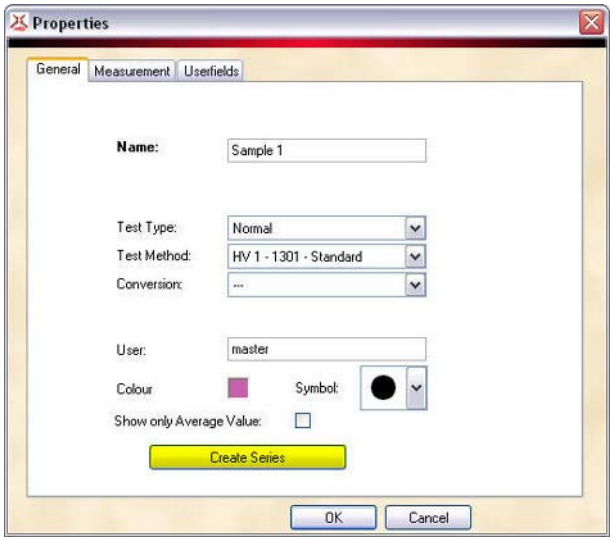


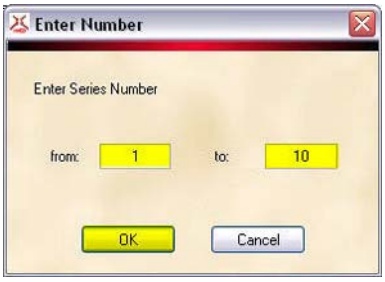
Creating Multiple Test Series

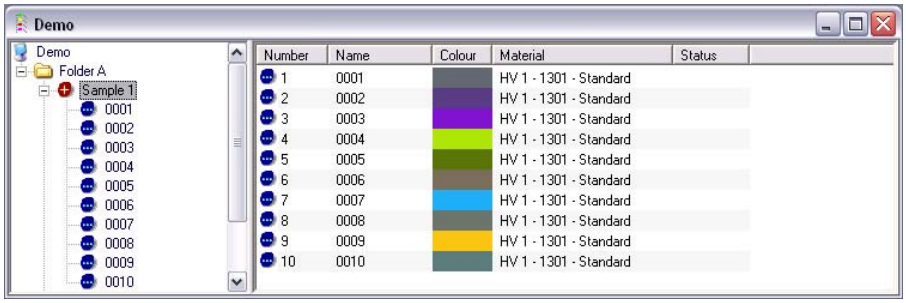


Creating numerous test series can be done in one step:

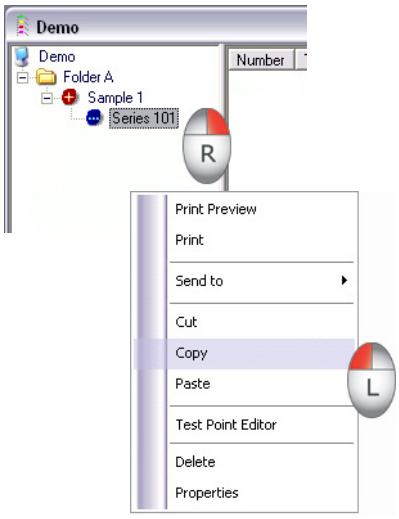
- Select the sample where the multiple test series is to be created.
- Right mouse click to open the context menu.
- Select *Properties*.
- Click **Create Series** to open the dialog box.
- Enter the number range of the series to be created and click **OK**.
- The series will be created automatically and inherit the properties defined for the sample.







Coping and Pasting Test Series

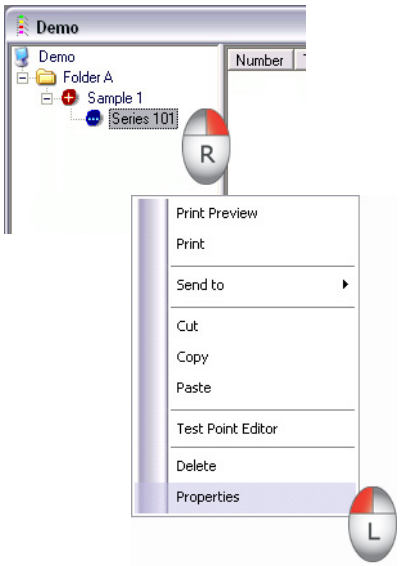


Test series including the properties set can be copied and pasted:

- Select the test series to be copied.
- Right mouse click to open the context menu.
- Select *Copy*.
- Select the sample where the copied test series is to be pasted.
- Right mouse click to open the context menu.
- Select *Paste*.
- Enter a name for the test series.
  The new test series automatically inherits the properties from the level above. If required, change the properties as described above.

HINT
If a test series is copied on several samples, not only the properties but also the test point pattern used will be copied. This is a fast way to create test series.

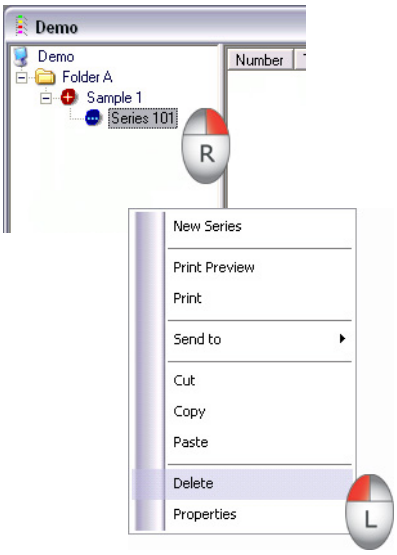
Editing Test Series Properties



The properties of a test series can be edited once created.
To edit the test series properties:

- Select the test series to be edited.
- Right mouse click to open the context menu.
- Select *Properties*.
- Edit the properties in the *Properties* window.
- Click **OK** to save the modified properties.

Deleting Test Series



To delete a test series:

- Select the test series to be deleted.
- Press the <Delete> key or right mouse click to open the context menu and select *Delete*.

Data Storage and Recommendations

In order to minimise the risk of data loss, please observe the following recommendations:

- The size of a data base should not exceed 1 MB. Measurement data should be organised in smaller data bases.
- To maintain a stable operation, do not install additional software or components on the PC.
  Connect the PC to a stable and uninterrupted power supply.
- A test series should contain max. 200 test points.
- Archive or back-up data onto a separate disc on a regular basis, e.g. on a daily basis.

4. Measuring a Single Indentation

Single Measurements

The *Single Measurement* command will produce an indentation and measure the hardness value. The hardness value will either be determined by an optical measurement or a depth measurement.

Optical Measurement

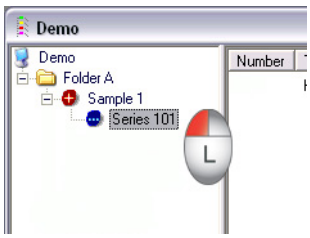
The optical measurement is achieved with image analysis where the size of the indentation is measured and calculated into a hardness value. This method is used for Vickers, Knoop and Brinell testing.

Depth Measurement

The optional depth measurement is achieved by measuring the depth the indenter penetrates into the material. This method is typically used for Superficial Rockwell testing. Image analysis is not used for this measurement.

Performing a Single Measurement

To perform a single measurement:

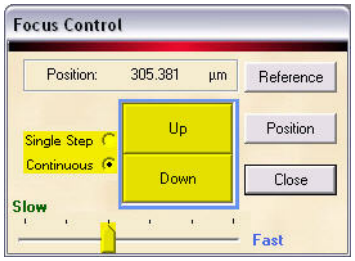


- Select or create a test series as described in the previous chapter.
- Lower the sample stage using the hand wheel.
- Place the test sample on the sample stage.

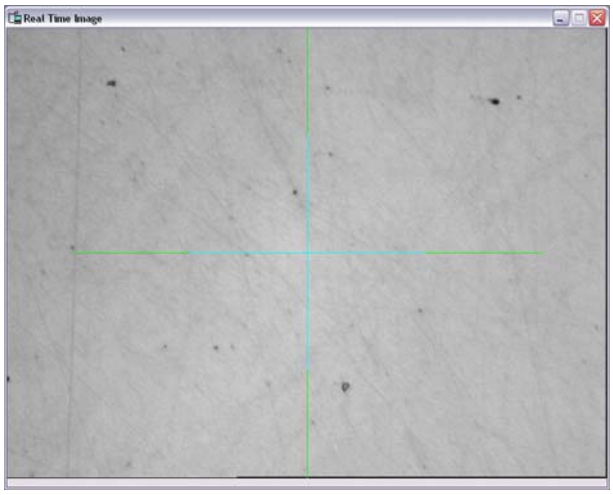
- Swivel in the lens system by pressing the <F7> function key or by selecting *Hardness Tester|Swivel in Lens* in the menu.

- Display the real-time image of the camera by pressing the <F10> function key or by selecting *View|Real Time Image* in the menu.
- Raise the sample stage using the hand wheel until a sharp image of the test sample surface is displayed on the screen.

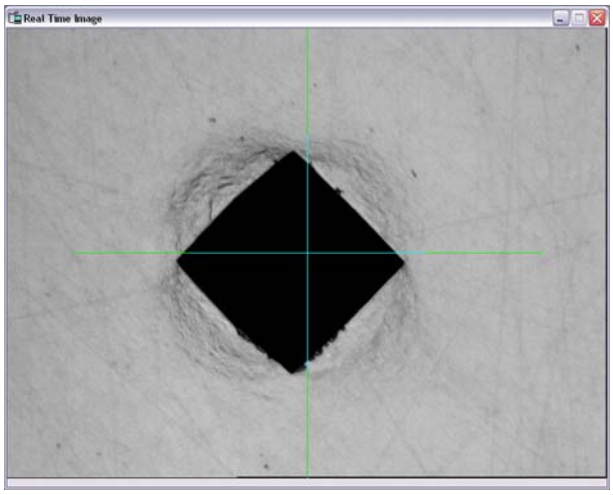
- If necessary, press the <F5> function key or select *Hardness Tester|Focus* in the menu to fine focus the image.



- If necessary, click on the crosshair and drag it to the centre of the screen where the indenter will penetrate the sample.



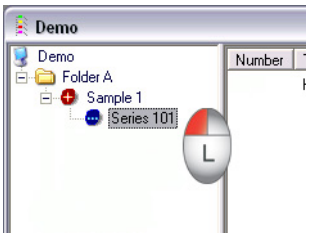
- Press the <F2> function key or the **Single Measurement** button in the tool bar or select *Measure*|*Single Measurement* in the menu to start the measurement cycle.
- The indent is now visible in the *Real Time Image* window.



The crosshair shows where the image analysis software will start its evaluation. It is therefore important that the crosshair is placed inside the indentation otherwise automatic evaluation is not possible.

- Before performing more tests, click on the crosshair and drag it to the centre of the indentation.

Measuring an Existing Indentation



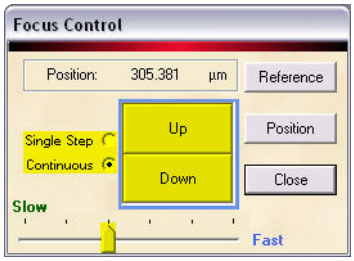
Indentations that already exist can also be measured e.g. an indentation that was made somewhere else.
To measure an indentation:

- Select or create a test series as described in the previous chapter.
- Lower the sample stage using the hand wheel.
- Place the test sample on the sample stage.

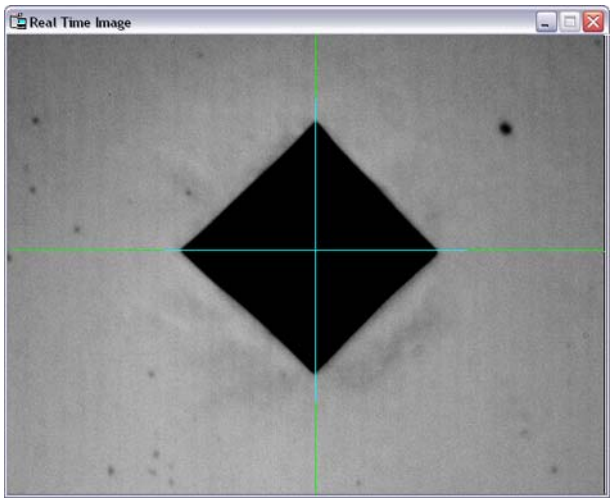
- Swivel in the lens system by pressing the <F7> function key or by selecting *Hardness Tester|Swivel in Lens* in the menu.

- Display the real-time image of the camera by pressing the <F10> function key or by selecting *View|Real Time Image* in the menu.
- Raise the sample stage using the hand wheel until a sharp image of the test sample surface is displayed on the screen.

- If necessary, press the <F5> function key or select *Hardness Tester|Focus* in the menu to fine focus the image.



- Move the sample to position the indentation under the hair cross on the screen.



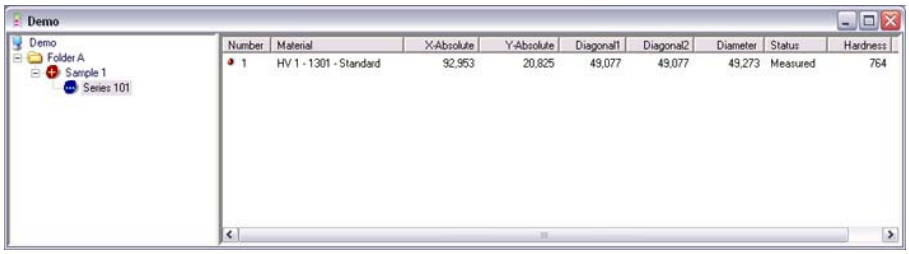
- Press the <F3> function key or the **Single Measurement without Penetration** button in the tool bar or select *Measure|Single Measurement without Penetration* in the menu to start the measurement cycle.

Reading the Measurement Result

When the measurement cycle has finished, the result is displayed in a number of ways.

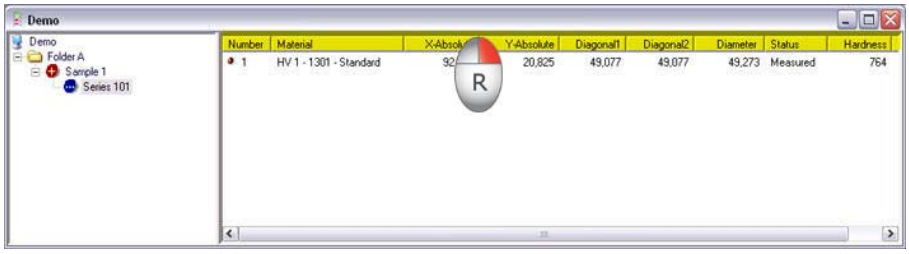
Test Specification Window

The calculated hardness value along with the measured diagonals and the test method is displayed in the *Test Specification* window.

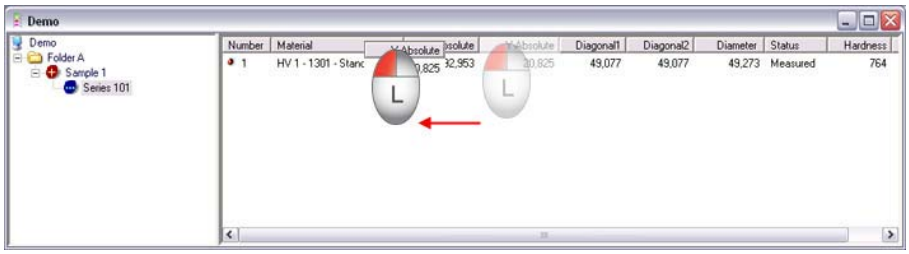


To determine which data fields are to be shown:

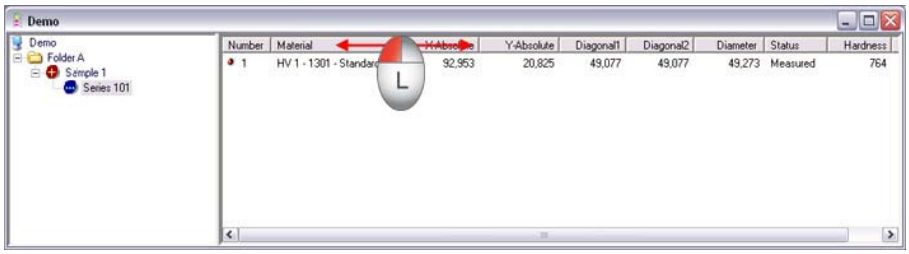
- Right click on the *Data Headline* row.



- A *Columns* dialog box with all available data fields opens. Tick the data fields you want to view in the *Test Specification* window and click **OK**.
- To change the order of the data fields, click on a data field in the headline and drag and drop to move it.



- To decrease or increase the column width click on the line between to data fields in the headline and drag to adjust the width.



Hardness Value Window

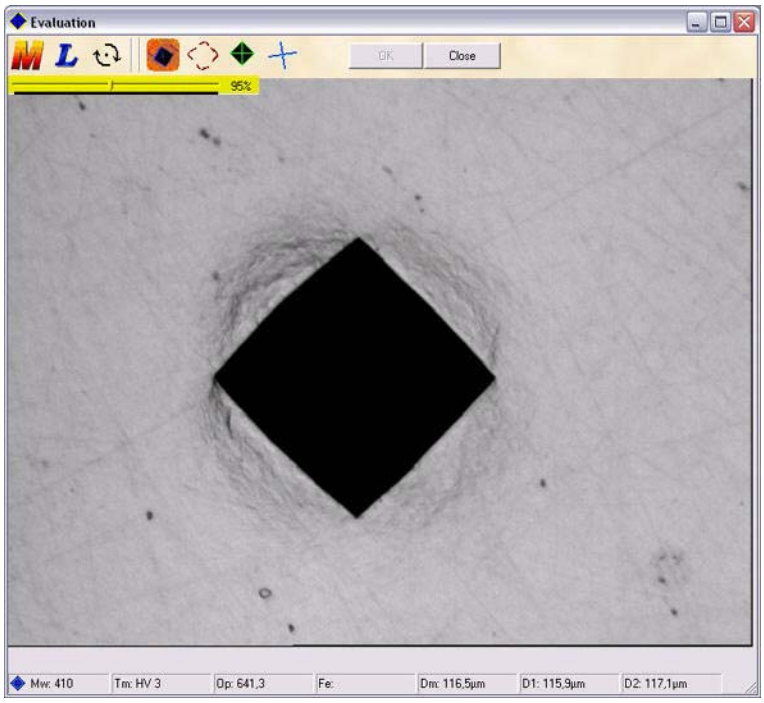
The hardness value is displayed in the *Hardness Value* window together with the test method.
If the *Hardness Value* window is not open:

- Select *View|Hardness Value.*

Image Evaluation Window

An image *Evaluation* window opens showing the measured indentation.

- Click on the zoom slider and drag to zoom in and out on the indentation.



Evaluating an Image

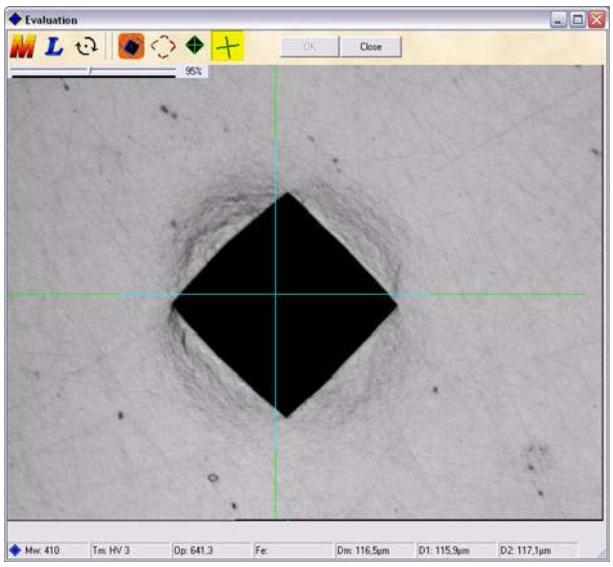
The image *Evaluation* window includes a number of tools that displays the automatic evaluation and allows re-measurement of an indentation.

PRECONDITIONS
Evaluation images are only available with optical measurement methods.
A Vickers, Knoop or Brinell test method has to be performed.

Show Crosshair

To display the crosshair:

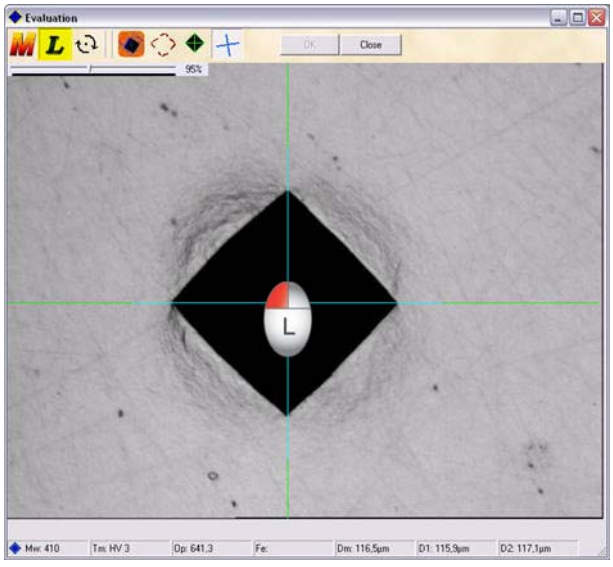
- Click the **Show Crosshair** button.



Position Crosshair

To move the crosshair:

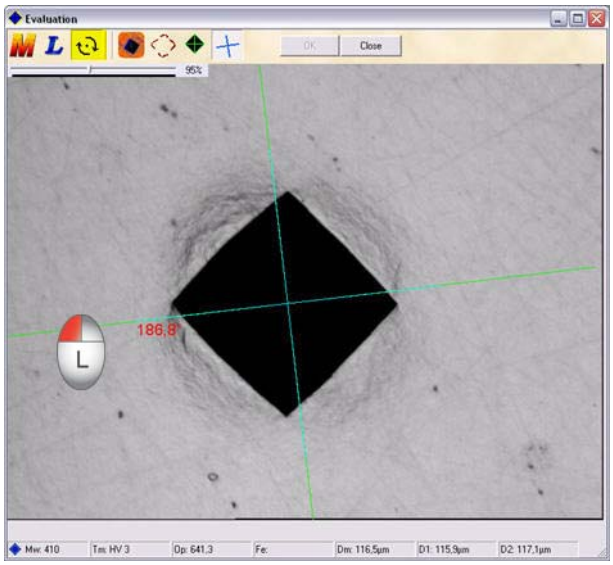
- Select the **Position Crosshair** button.
- Mouse click in the centre of your indentation to place the crosshair or click and drag it in place.



Rotate Crosshair

If necessary, the crosshair can be turned to intersect with the corners of the indentation:

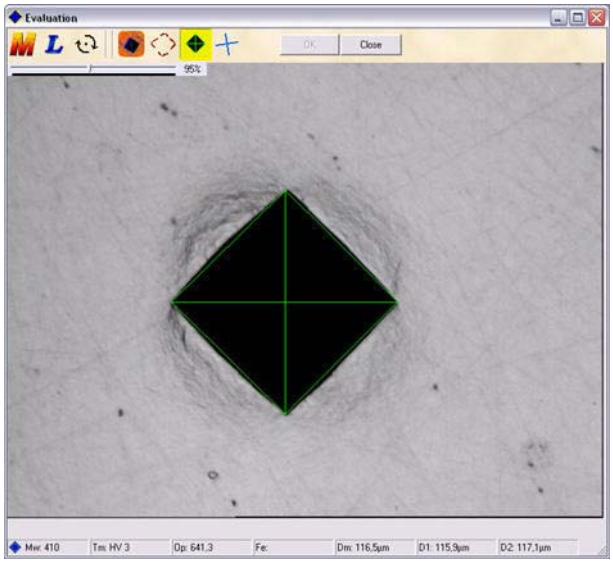
- Select the **Rotate Crosshair** button.
- Mouse click on one of the crosshair lines and drag the crosshair to turn it.



Show Automatic Evaluation

To view the result of the automatic evaluation:

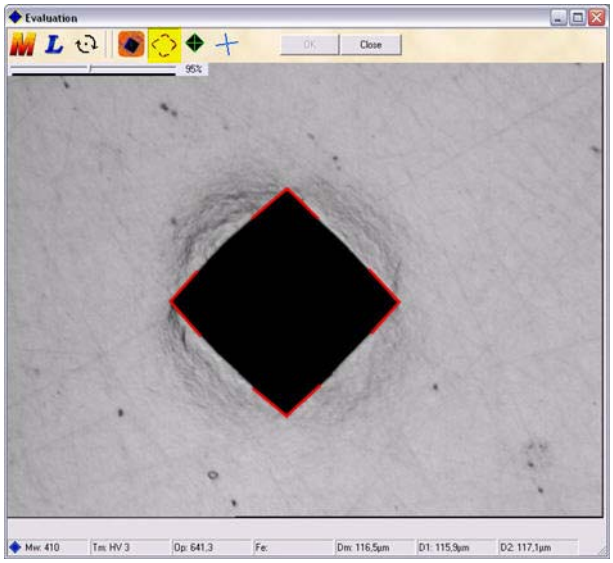
- Select the **Show Automatic Evaluation** button.
  The evaluation should identify the corners correctly.



Show Corner Recognition

To view how well the image analysis software identified the corners of the automatic evaluation:

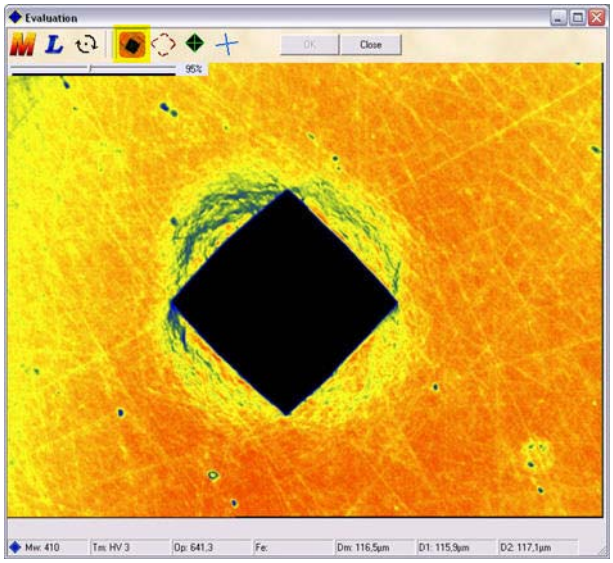
■ Select the **Show Corner Recognition** button.
The red lines should follow the indent closely.



Show Colours

To view the image in colour:

■ Select the **Show Colours** button.
The entire indent should be black. If the indent edges are lighter coloured (e.g. blue) then contrasting should be improved.

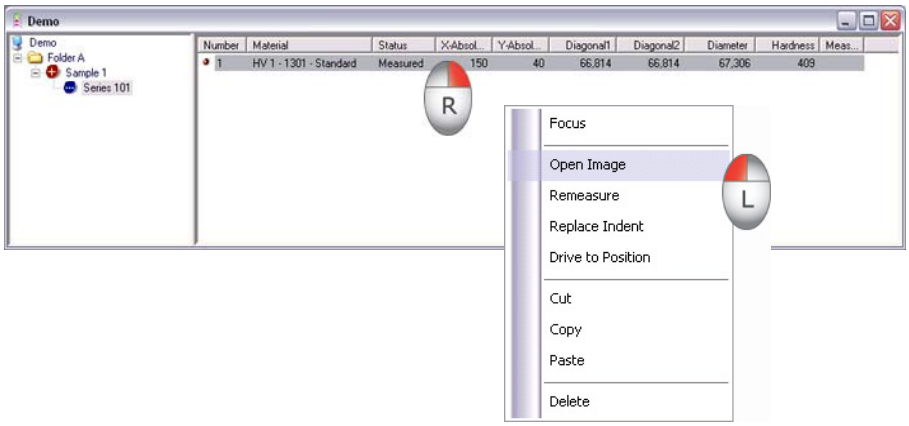


For more information on contrast settings, please refer to *Creating a New Test Method* in chapter 15 *Test Methods and Surface Settings*.

Opening an Image

Images of a previously performed measurement value can be opened and viewed.
To open an image:

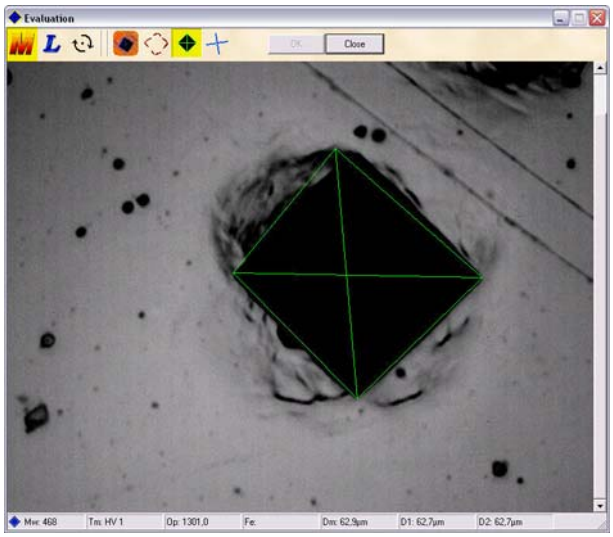
- Select the relevant test measurement.
- Right mouse click to open the context menu.
- Select *Open image*.



IMPORTANT
Images might be deleted automatically after a number of days.
Please refer to chapter 14 on *General Settings*.

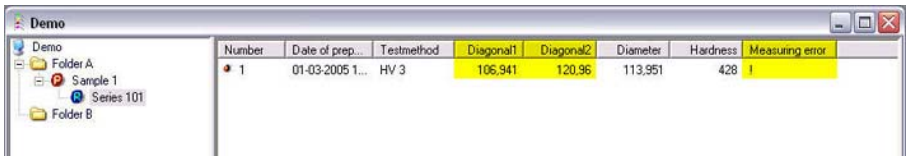
Re-measuring an Indentation

In some situations automatic evaluation is not completed successfully. Typical reasons are vibrations during evaluation, that the crosshair is not placed inside the indentation, or that the indentation is disturbed by artefacts on the sample surface, making automatic image analysis inaccurate.

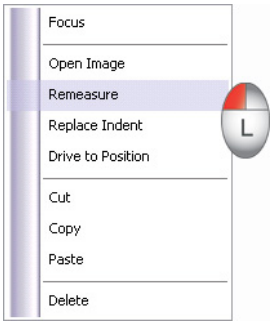


NOTE

A measurement will be marked with "**!**" in the measurement error column, if the automatic evaluation results in diagonals which deviate more than the standards allow.
A measurement will be marked with "*****" in the measurement error column, if an evaluation error has occurred e.g. due to vibrations.
In both cases re-measuring or replacement of the indentation is necessary.

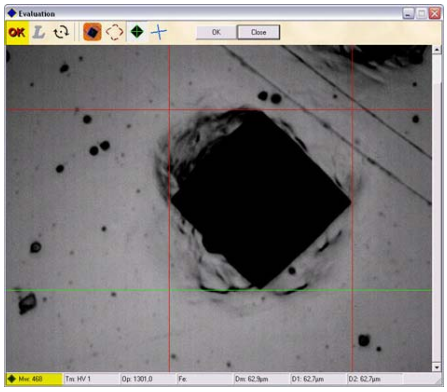


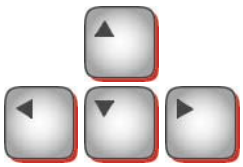
Manually Re-measuring an Indentation



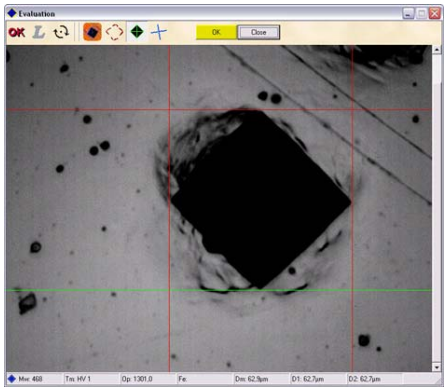
To manually re-measure an indentation:

- Select the relevant test measurement.
- Double-click on the measurement or right mouse click to open the context menu and select *Remeasure* to open the image *Evaluation* window.
- Left mouse click on a measurement ruler (vertical and horizontal lines in the window) and drag it to the corner of the indentation.





- Press the arrow keys to fine position the ruler.
- Repeat for all four indentation corners.
- Click **OK** to read the new hardness value and the diagonals.

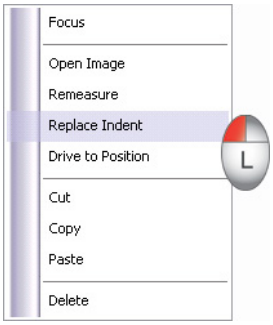


- Click **OK** to accept the re-measurement.

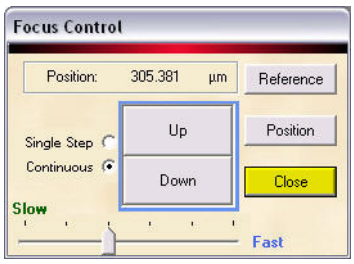
Automatically Re-measuring an Indentation

To automatically re-measure an indentation:

- Select the relevant test measurement.
- Right mouse click to open the context menu.
- Select *Drive to Position* to move the XY-stage to the relevant indentation.
- Right mouse click to open the context menu again.
- Select *Replace Indent*.
- In the top dialog box click **Remeasure**.



- The *Focus Control* window opens to fine focus the image.
  Note: focus on the sample surface e.g. scratches etc. not on the indentation.
- **Close** the *Focus Control* window and the indentation is remeasured.

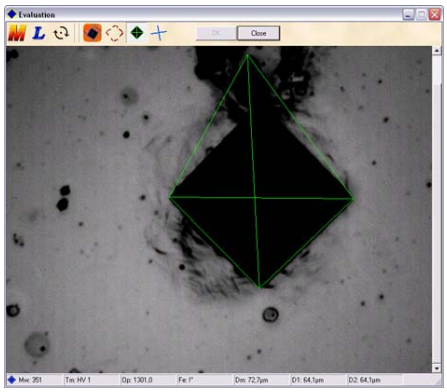


- The image *Evaluation* window is opened.
- Click **Close** to accept the re-measurement or adjust manually by pressing the **Manual Measuring of indent** button and proceed as described above (Manually Re-measuring an Indentation).

NOTE
A re-measured indentation will be marked with a “N” in the measurement error column.

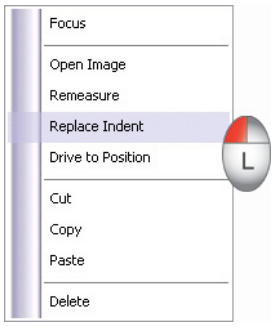
Replacing an Indentation

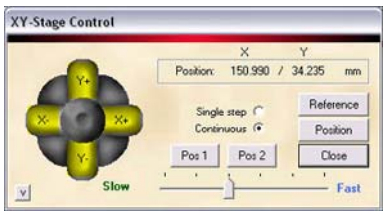
An indentation can be replaced should there be too much interference from artefacts on the sample surface.



To replace an indentation:

- Select the relevant test measurement.
- Right mouse click to open the context menu.
- Select *Drive to Position* to move the XY-stage to the relevant indentation.
- Right mouse click to open the context menu again.
- Select *Replace Indent*.
- In the opened dialog box, use the XY-stage controls to move to a new position or mouse click and drag in the real-time image to move to a new position.

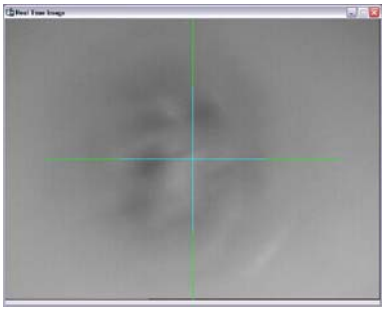




- In the top dialog box click **OK** to start the test run.

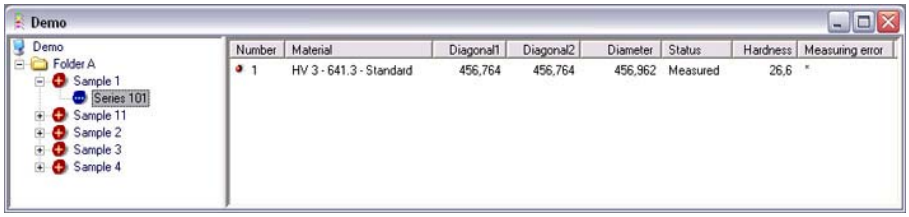
- In the *Test Specification* window the error measurement has been replaced by a new measurement.

Image Out of Focus

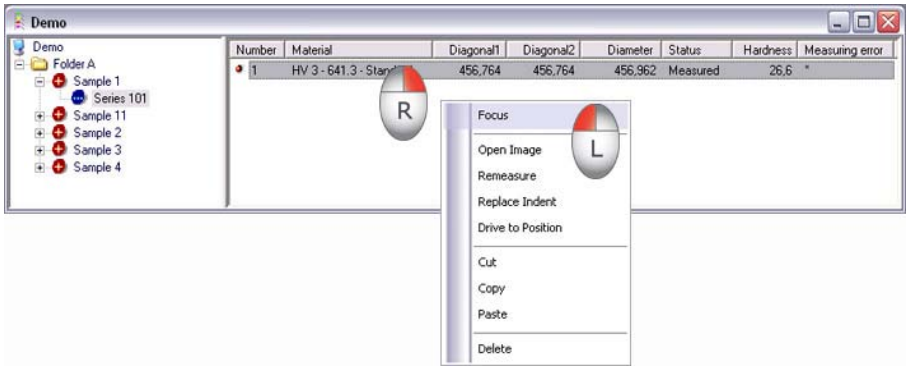


If the real-time image does not provide a sharp and in focus picture of the indentation:

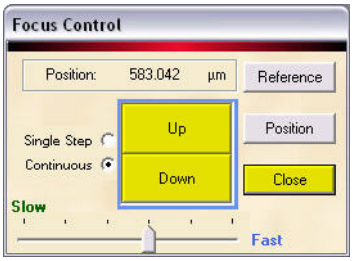
- An evaluation error "*" will be indicated in the *Test Specification* window.

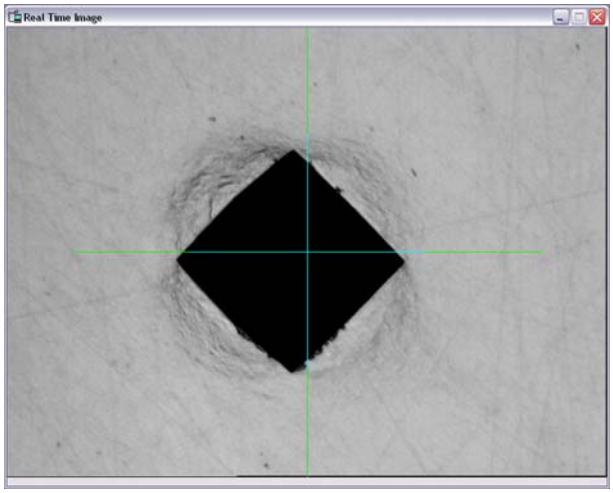


- In the *Test Specification* window right mouse click to open the context menu.
- Select *Focus* to open the *Focus Control* window.

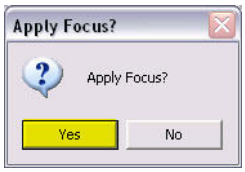


- Click and hold the **Up** or **Down** buttons until the real-time image is in focus.
  If necessary, move the slider between **Slow** and **Fast** to set the focussing speed.
- Click **Close** to close the *Focus Control* window.





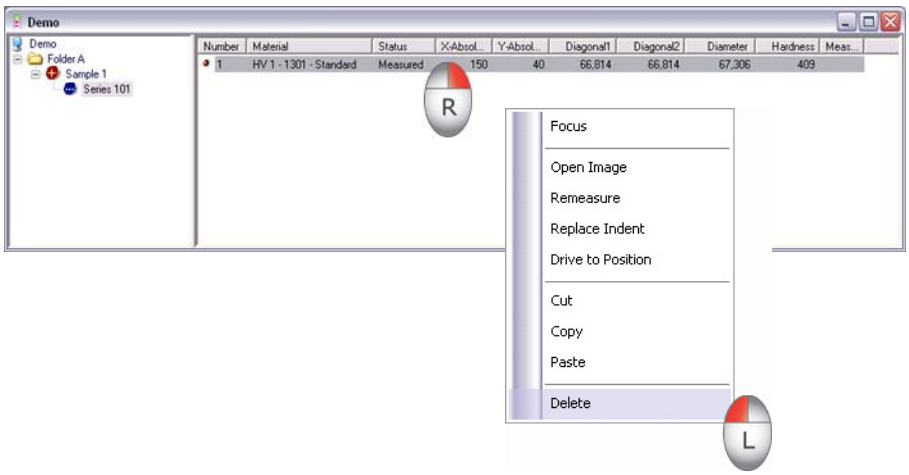
- Click **Yes** to apply and save the focus setting.
- Re-measure the indentation as described above.



Deleting a Measurement

To delete a measurement:

- Select the relevant test measurement.
- Press the <Delete> key or right mouse click to open the context menu and select *Delete*.



To delete several measurements:

- Hold the <Ctrl> key down while clicking to select several measurements.
- Delete with the <Delete> key or right mouse click to open the context menu and select *Delete*.

5. Measuring Series of Indentations

Series Measurement

With the series measurement function it is possible to measure a large number of test points in one testing cycle. The position of each test point is determined in advance and the positions of all the test points are referred to as a test point pattern.

Test Points

Test points are defined in the *Test Point Editor*. A test point pattern can be defined in several ways:

- Coordinates for each test point can be entered directly
- Test points can be selected from a chart.
- Test points can be selected visually using the optional overview camera.

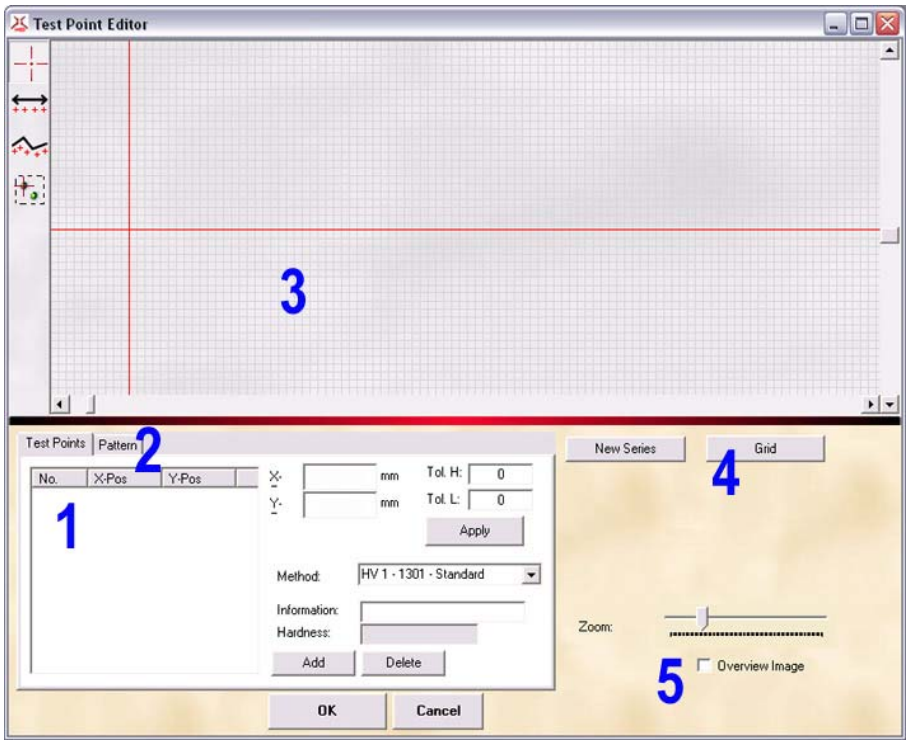
Which method to use depends on the test sample characteristics and personal preference. A test point pattern can be saved and recalled for later use.

Test Point Editor

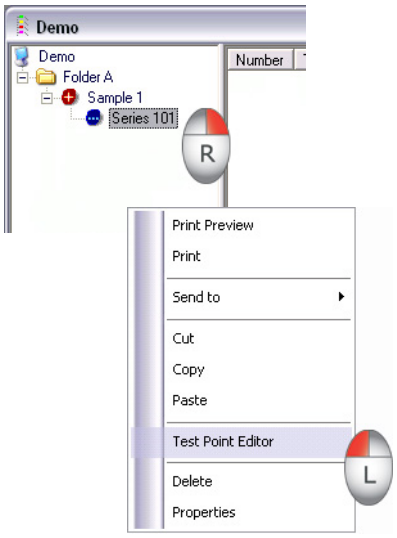
The Test Point Editor is divided into five areas:

1. Test point coordinates
2. Test point pattern
3. Test point chart
4. Grid settings
5. Overview image

Test Point Editor Layout

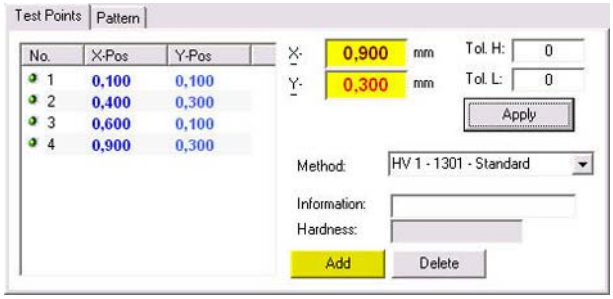


Entering Test Point Coordinates



To enter test point coordinates directly:

- Select or create a measurement series.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.
- In the *Test Points* section of the window, enter an X and a Y coordinate. The coordinates refers to an arbitrary starting point, which will be defined upon measuring.
  - Statistical tolerances for this specific test point may be entered her (Statistical tolerances valid for all test points should be set in the test series properties)
    A test method can be selected and additional information can also be entered for the specific test point.
- Click **Add** to enter a test point.
- Repeat this for all the test points.
- Click **OK** to submit the test points and close the window.



Adding Test Points

Further test points can be added at any time by returning to the *Test Point Editor*.
To add extra test points:

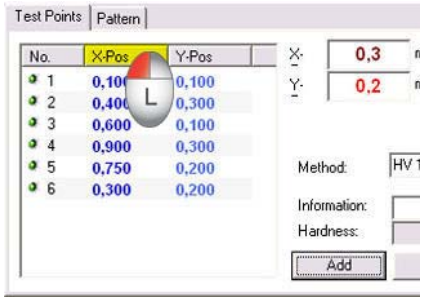
- Follow the procedure above.

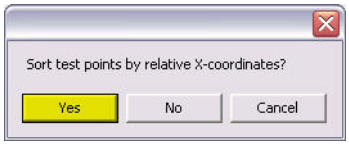
NOTE:
A maximum of 200 test points can be entered in a test series.

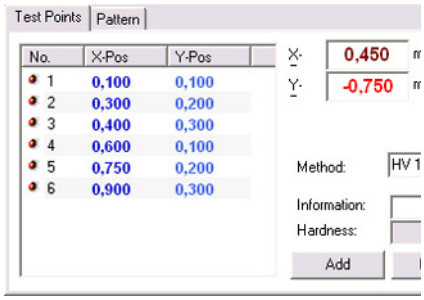
Sorting Test Point Order

The order of the test points can be sorted after being entered.
To sort the test points:

- Click on the **X-Pos** column headline.
- In the opened dialog box, click **Yes** to sort the test points by the relative X-Position.



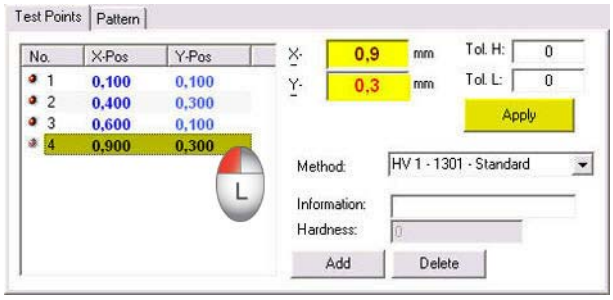




Editing Test Points

To edit one or more test points:

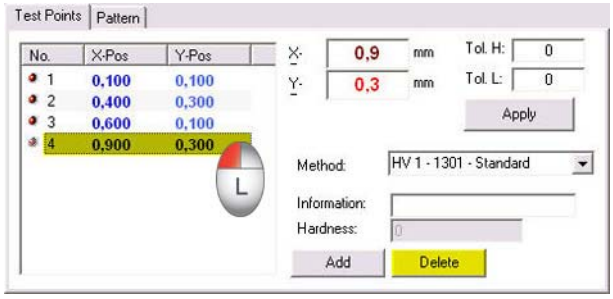
- Select the test point coordinates of the test point to be edited.
- Edit the coordinate values and click **Apply** to accept.



Deleting Test Points

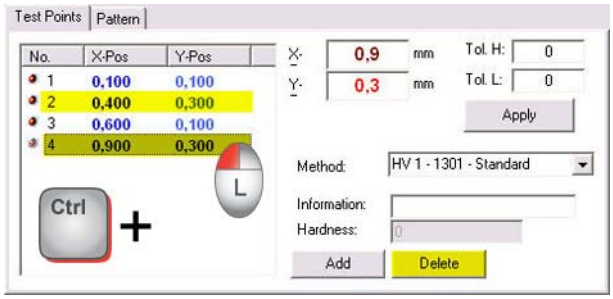
To delete a test points:

- Select the test point coordinates to be deleted.
- Press the <Delete> key or click **Delete**.

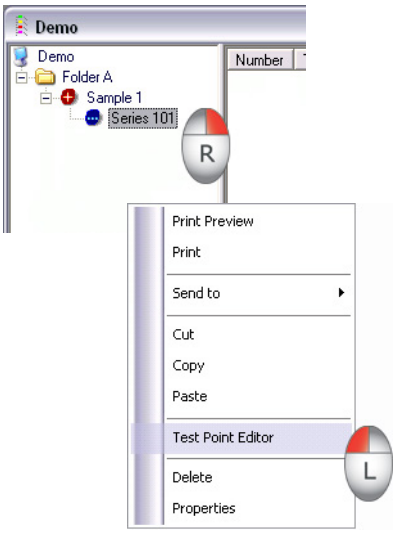


To delete several test points:

- Hold down the <Ctrl> key while selecting several coordinates. To select all coordinates, hold the <Shift> key while selecting the first and the last coordinates.
- Press the <Delete> key or click **Delete** to delete all selected coordinates.

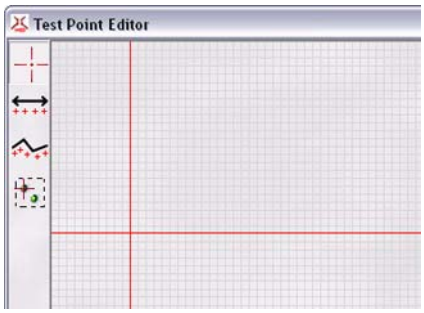


Setting Test Points in a Chart



To open the test point chart:

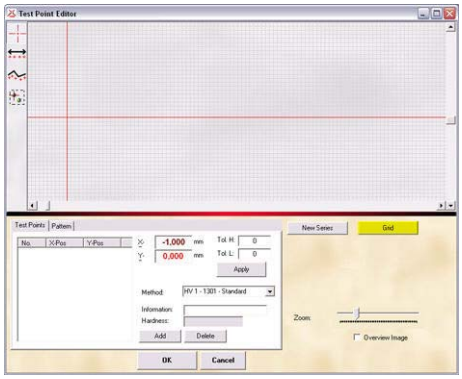
- Select or create a measurement series.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.

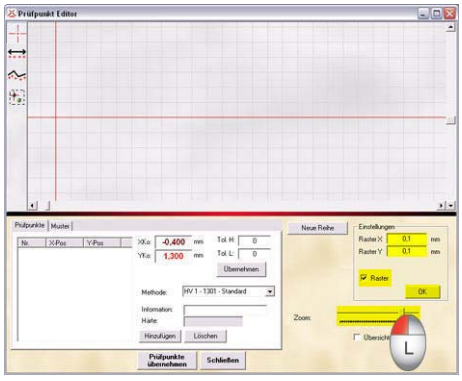


Adjusting the Chart Grid

The grid size can be adjusted. To open the grid settings:

- Click the **Grid** button.
- Tick **Snap to grid** if required (the test points will then snap to the grid).
- Enter the grid size or move the *Zoom* slider to adjust the grid size.
- Click **OK** to accept the grid settings.

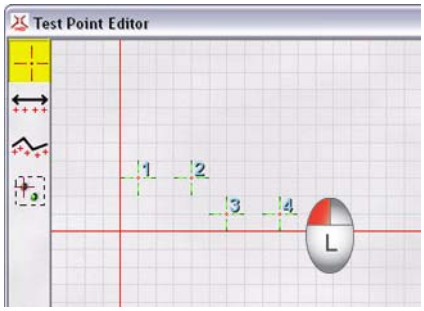




Setting Individual Test Points

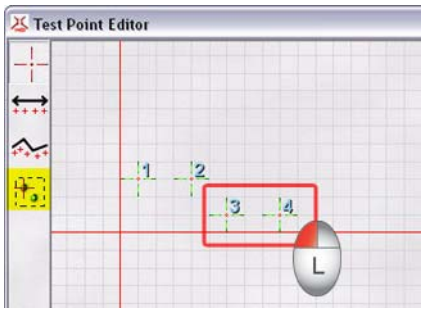
To set the test points in the test point chart:

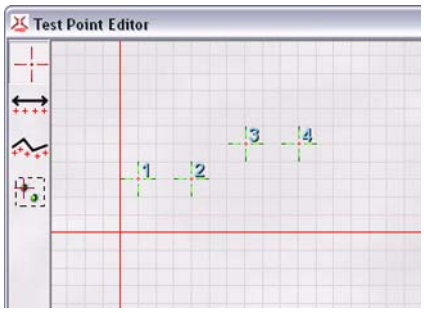
- To set a test point, select the **Set Test Point** tool and simply mouse click in the chart to set a test point.
- Repeat to set all your test points.



Moving Test Points

- To move one or more test points, select the **Select and Move Test Points** tool and click and drag the mouse to select one or more test points.
- Click and drag the selected points to a new position.
- Click **OK** to submit the test points and close the window.





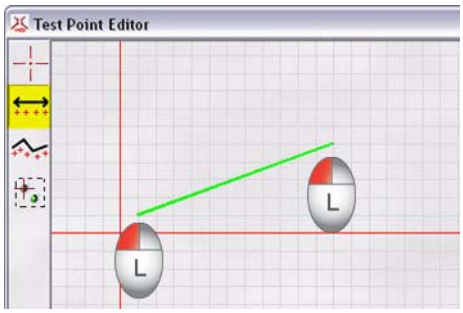
Deleting Test Points

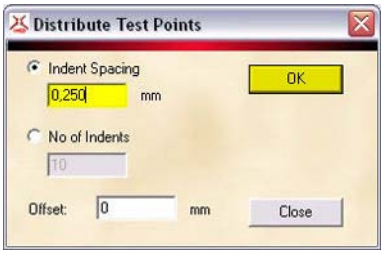
- To delete a test point, select one or more test points with the **Select and Move Test Points** tool and click <Delete> or delete the test point coordinates as previously described.

Setting a Line of Test Points

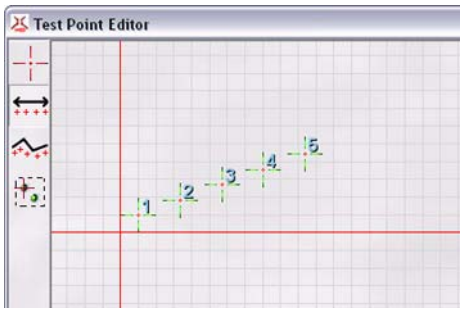
With the *Test Point Editor* it is easy to set test points on a straight line or a polygon line:

- To draw a line, select the **Line or Polygon line** tool.
- Left mouse click in the chart to set the starting point of the line and left mouse click in the chart, where the line is to end.





- In the opened dialog box, enter either the desired indent spacing or the desired number of indents.
- Click **OK** to close the dialog window.
- Click **OK** to submit the test points and close the window.



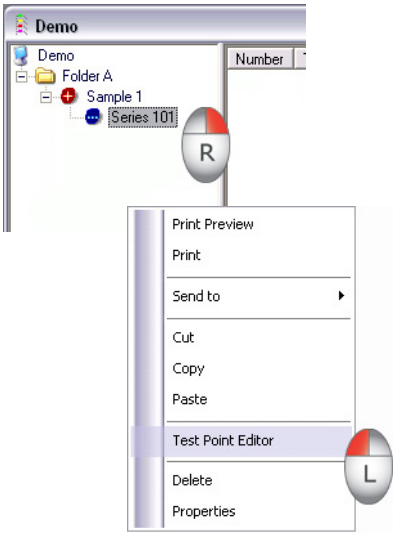
Setting Visual Test Points

With the optional overview camera the entire sample surface can be viewed and set test points directly.

PRECONDITIONS
In order to select visual test points and utilise the features described below, Duramin-A300 needs to be equipped with an overview camera, and the ecos 2nd Camera software needs to be installed.

IMPORTANT
Before setting visual test points using the overview camera, make sure that the sample surface is in focus under the objective lens. Incorrect height position of the sample will result in inaccurate positioning of the test points set under the overview camera.

NOTE
Objective lens distortion at 40x50 mm field of view:
< 2mm (at max. 80% field of view)

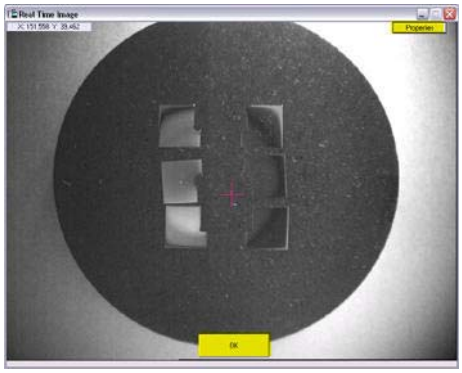


To select visual test points:

- Select or create a measurement series.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.
- Select **Overview Image**.

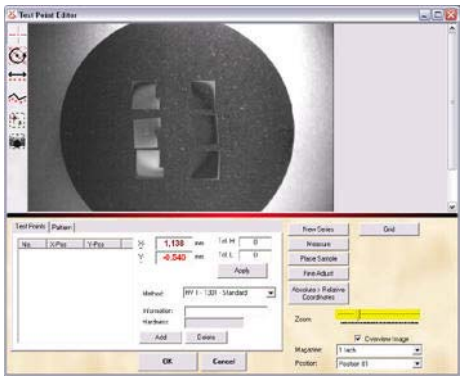
The XY-stage will move to the overview camera. A new window with a real-time image from the overview camera opens.

- Place the test sample under the overview camera.
- To adjust the brightness of the overview image click the **Properties** button.
- Click **OK** to accept the sample positioning.



Zooming in/out on Overview Image

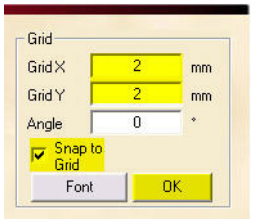
■ In the *Test Point Editor* a digital image of the test sample from the overview camera can now be seen.
If necessary, zoom in or out by sliding the **Zoom** slider.

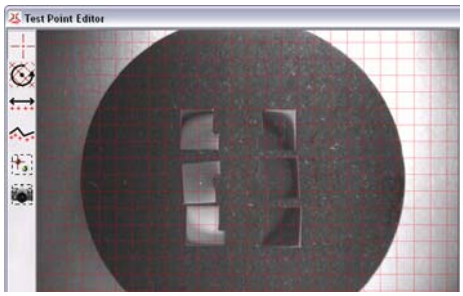


Adding Grid to Overview Image

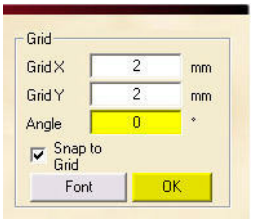
A grid can be turned on/off to facilitate selection of test point positions.

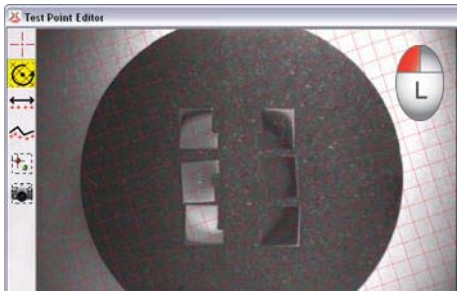
■ Click **Grid** to open the *Grid* options.
■ Tick **Snap to Grid** to add/remove the grid.
■ To set the desired grid spacing, enter appropriate values.





■ To rotate the grid, click the **Turn Grid** tool and drag the grid to the desired angle, or enter an angle value and click **OK**.



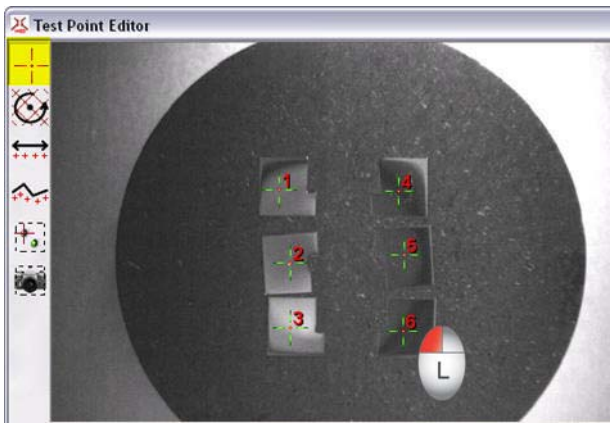


NOTE
The test points set will snap to the grid. The grid spacing should therefore not exceed the desired indent spacing.

Setting Individual Test Points

To set a test point:

- Select the **Set Test Point** tool and simply mouse click in the overview image.
- Repeat to set all test points.



To delete a test point:

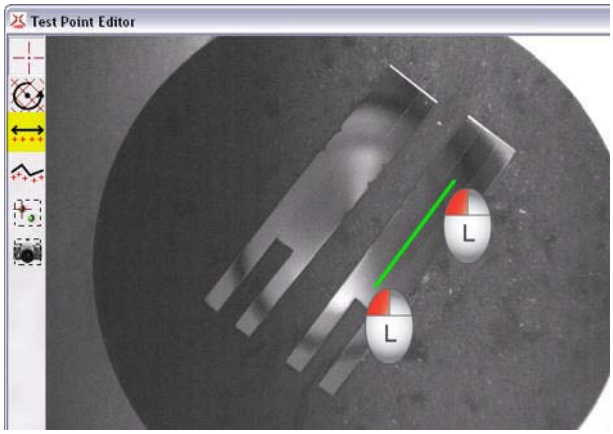
- Select the test point with the **Select and Move Test Points** tool and click <Delete> or delete the test point coordinates as previously described.
- Click **OK** to submit the test points and close the window.

Setting a Line of Test Points

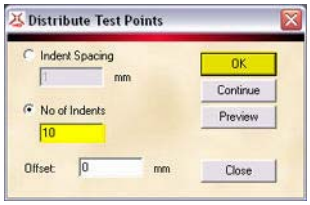
With the *Test Point Editor* it is easy to select test points on a straight line or a polygon line.

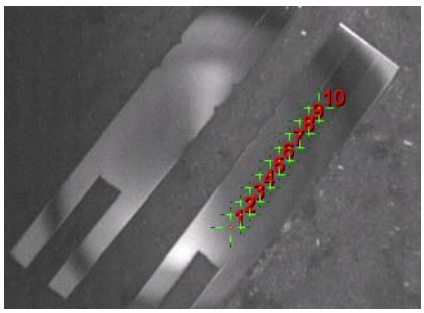
To draw a line:

- Select the **Line** or **Polygon Line** tool.
- Left mouse click in the overview image to set the starting point of the line and left mouse click in the image, where the line is to end.



- In the opened dialog box, enter either the desired indent spacing or the desired number of indents.
- Click **OK** to close the dialog window.
- Click **OK** to submit the test points and close the window.

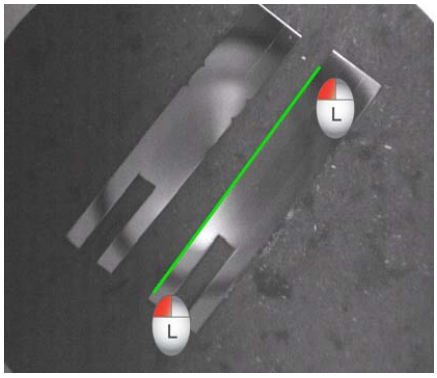


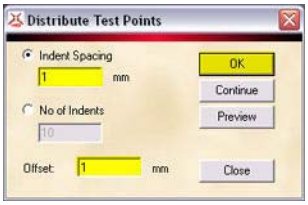


Setting a Line Offset

To make a line of indents along an edge, the line offset feature facilitates fast positioning:

- Select the **Line** or **Polygon Line** tool and draw a line along the sample edge as described above.





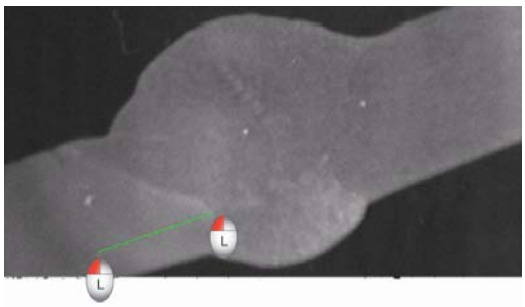
- In the opened dialog box, enter either the desired indent spacing or the desired number of indents.
- Enter the desired offset. Positive values will offset the line downwards; negative values will offset the line upwards.
- Click **Preview** to get a preview of the offset.

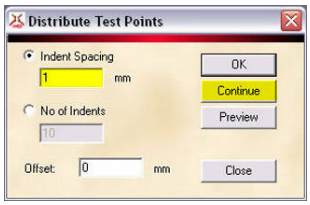
- Click **OK** to close the dialog window.
- Click **OK** to submit the test points and close the window.

Variable Indent Spacing

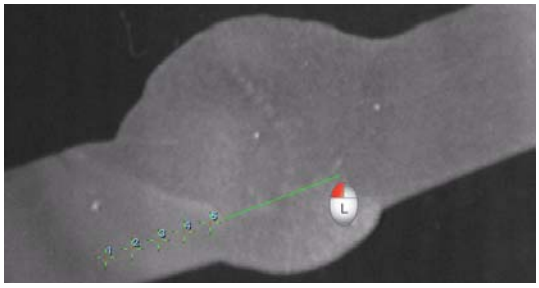
In some cases, it is desirable to space indents closer in some areas and broader in other areas e.g. welds. Variable indent spacing along the line can be set using the line and polygon line tool:

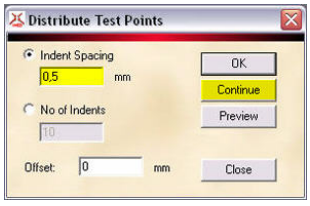
- Select the **Line or Polygon Line** tool.
- Left mouse click in the overview image to set the starting point of the line and left mouse click in the image, where the first part of the line is to end.



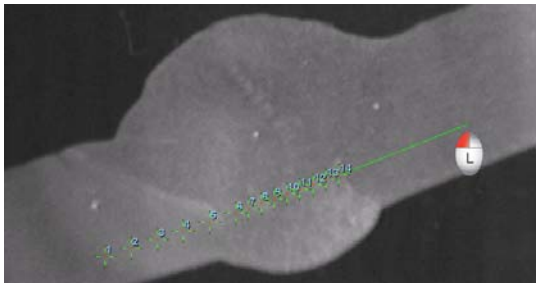


- In the opened dialog box, enter the desired indent spacing for the first part of the line.
- Click **Continue**.
- Left mouse click to set the end point of the second part of the line.

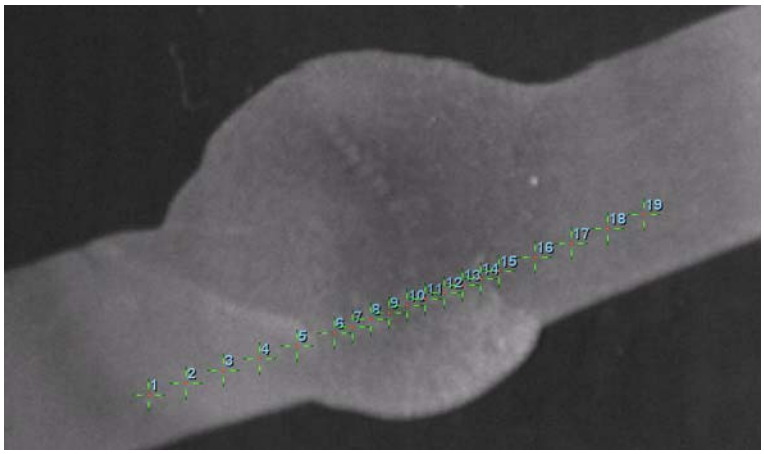




- In the opened dialog box, enter the desired indent spacing for the second part of the line.
- Click **Continue** to repeat or click **OK** to close the window.



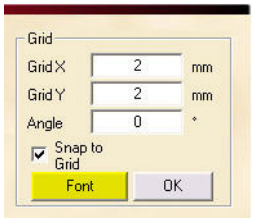
- Click **OK** to submit the test points and close the *Test Point Editor* window.



Changing the Font

The font size and colour of the test points can be changed:

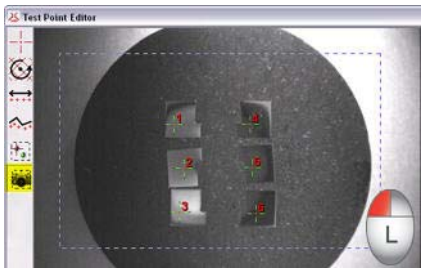
- Click the **Grid** button to open the *Grid* settings.
- Click **Font** to open the *Font* dialog box.
- Select font type, style, size and colour and click **OK**.

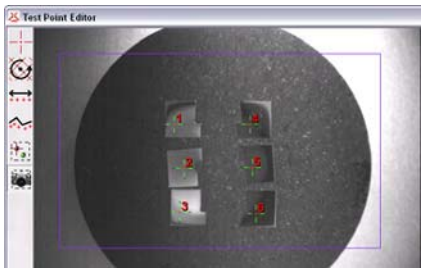


Saving Overview Image

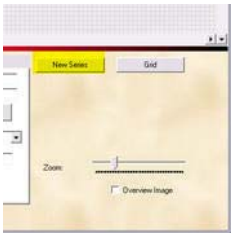
In many cases it is useful to include an image from the overview camera in the report.
To save an image:

- Select the **Select and Save Image Region** tool
- Click and drag a rectangle around the image region to be saved.
- Release the mouse to save the image.





Creating New Series



New series can be created directly in the *Test Point Editor*. This is a useful tool as several series for a sample can be defined with the test runs then being automatically performed.
To create a new series:

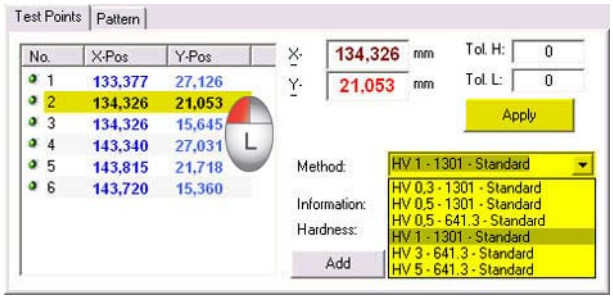
- Enter test point coordinates or select visual test points as described above.
- Click **New Series** to save the test point pattern and open a new series.

Applying a Test Method

The test method for the test points is shown in the *Test Point Editor*. The method is inherited from the test series specification. However, the test method can be changed within the *Test Point Editor*, and different test methods can even be selected for the individual test points.

To select a test method:

- Select the test point coordinates for a test point.
- To select several test points, hold the <Ctrl> key while selecting test point coordinates.
- Select the desired test method in the drop down list.
- Click **Apply** to accept.

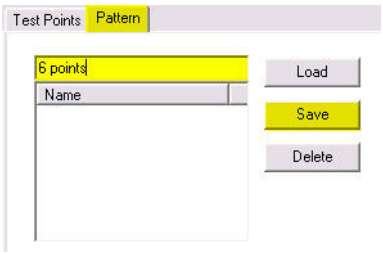


NOTE
A test method is a combination of an indenter, an objective lens and a surface setting. Make sure that the selected indenter and lens are mounted on the hardness tester.

Test Point Patterns

Once a test point pattern has been created, it is saved with the test series it was created in. It can also be saved for future use on new samples.

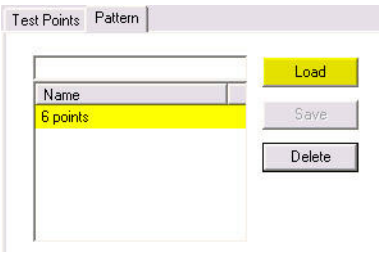
Saving a Test Point Pattern



To save a test point pattern:

- If the *Test Point Editor* window is not open, select the measurement series that contain the test point pattern to be saved.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.
- Select the *Pattern* tab.
- Enter a name for the pattern to be saved and click **Save**.
- Click **OK** to close the *Test Point Editor* window.

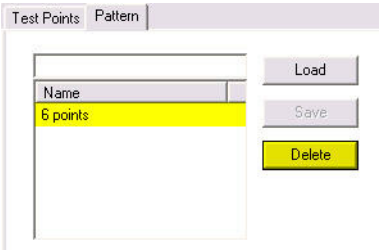
Loading a Test Point Pattern



To load a test point pattern that has previously been saved:

- Select the measurement series that where the test point pattern is to be applied.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.
- Select the *Pattern* tab.
- Select the pattern to be loaded and click **Load**.
- Click **OK** to close the *Test Point Editor* window.

Deleting a Test Point Pattern

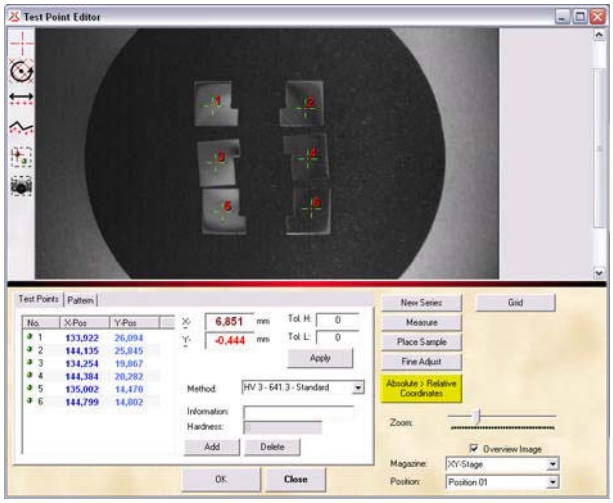


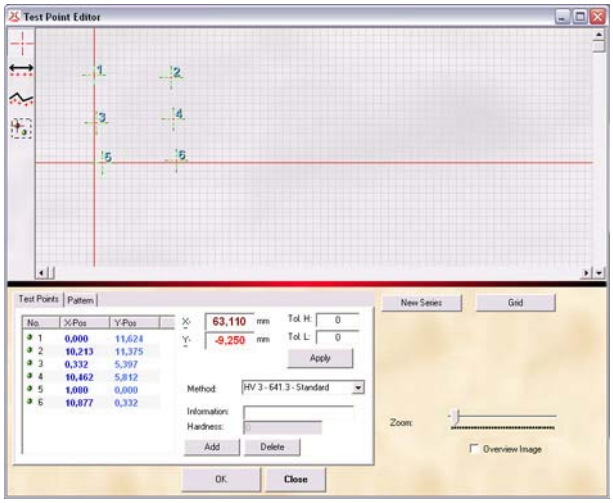
To delete a test point pattern:

- Select the pattern to be deleted.
- Click **Delete**.
- Click **OK** to close the *Test Point Editor* window.

Absolute and Relative Coordinates

Test points created as coordinates or in the test point chart are defined with an arbitrary starting point. Test points created with the overview camera however, are defined with an absolute starting point.
To save a test point pattern for future use, the absolute coordinates must first be converted to relative coordinates, as the test point pattern will be re-used on different samples and on different positions.
To convert absolute coordinates to relative:
Click the **Absolute > Relative Coordinates** button.





Performing a Series Measurement

Once a test point pattern has been defined for a test series, series measurements can now be performed.

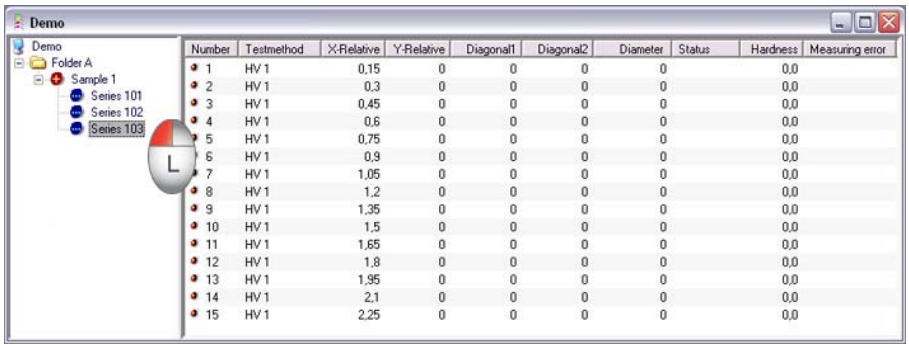
> ***NOTE***
> When test point coordinates have been entered directly or set using a test point chart, these coordinates are relative to an arbitrary starting point. The starting point has not yet been defined.

> ***NOTE***
> When test points have been set using an overview camera, these coordinates are absolute. The starting point has already been defined.

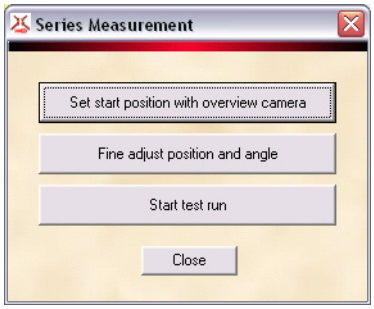
Measuring Test Points with Relative XY-coordinates

To start measuring:

- Select the measurement series that contains the test point pattern to be measured.



- Press the **Series Measurement** button in the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement* in the menu.
- A dialog window will open with the following options:
  - Set start position with the overview camera
  - Fine adjust position and angle under the objective lens
  - Start the test run



Starting Test Run

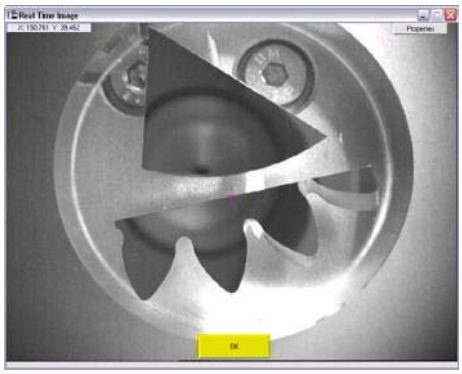
To start the test run without selecting start position or adjusting the angle:

- Click **Start test run** to start.

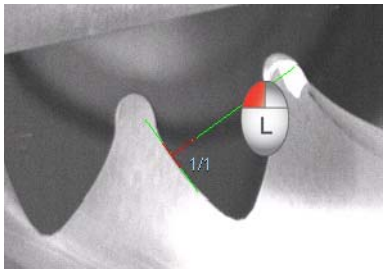
Setting Start Position

To use the overview camera to select the starting position:

- Click **Set start position with overview camera** and the XY-stage will move to the overview camera.
  A new window with a real-time image from the overview camera opens.
- Place the test sample under the overview camera and click **OK**.



- A digital image from the overview camera will open in the *Set Starting Point* window.
- A red T-line indicates the test series. Click and drag the T-line to position the test series.
- Click on the T-line to activate turning lines on the T-line, and turn the T-line to adjust the angle.

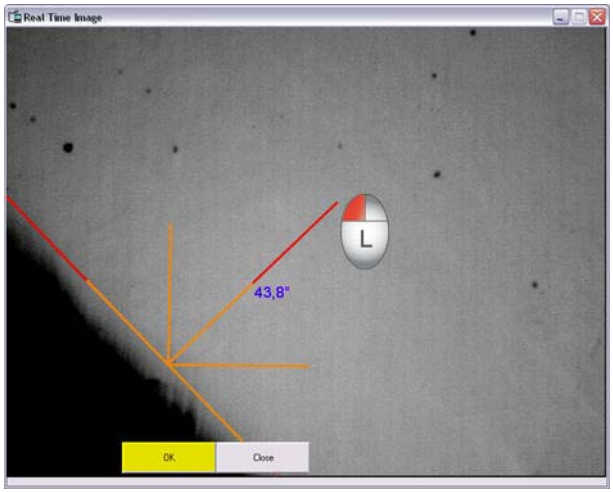


- Click **Apply** to accept the position and angle and start measuring or click **Fine Adjust** to proceed with fine positioning.

Fine Adjust the Starting Position

To fine adjust the start position and the angle in the real-time image using the objective lens:

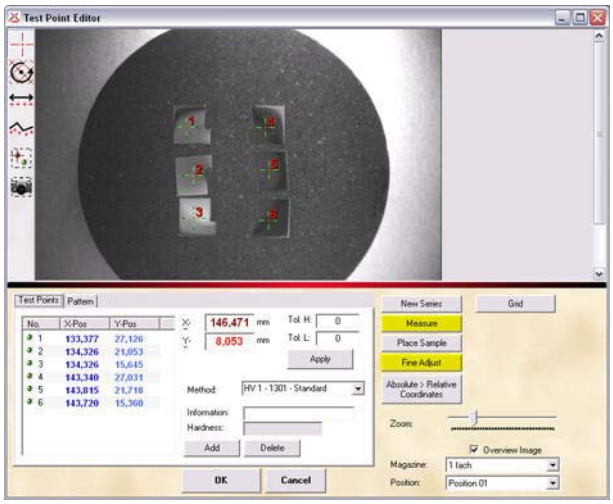
- Click **Fine adjust position and angle**.
- A new window with a real-time image of the sample opens. Move to another position with the XY-Stage Control, or simply left click in the real-time image and drag the mouse to the desired position.
- To adjust the angle, left mouse click on the red lines and drag the mouse to turn the T-line.
- To accept the position and angle and start the test run click **OK**.



Measuring Test Points with Absolute XY-coordinates

If the test points have been set using an overview camera, measurement can be started directly by selecting fine positioning within the *Test Point Editor*:
To fine position each test point:

- Click **Fine Adjust**.
- To start the test run, click **Measure**.



Alternatively:

- Select the measurement series that contains the test point pattern to be measured.

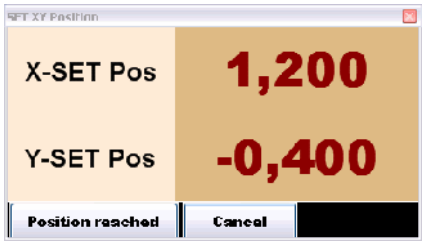
- Press the **Series Measurement** button in the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement* in the menu and the rest run will start immediately.

IMPORTANT
Do not move the sample on the XY-Stage during the selection of test points and measuring. This will prevent the software from finding the correct coordinates. Only move the XY-Stage with the stage control.

Series Measurement with a Manual Cross Slide

The Series Measurement function can also be used on Duramin-A300 version A or B with a manual cross slide.

- Follow the procedure for setting test points in the *Test Point Editor*, fine position test points and measure as described above.
- When the cross slide is to be moved to a new position, a dialog box will open and give the new position.



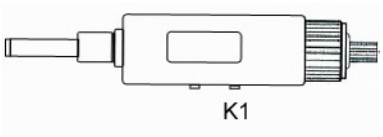
- With version B with position feedback, the dialog box will also show the current position.

- Turn the micrometers on the cross slide to move to the new position.
- Click **Position reached** to confirm the movement.

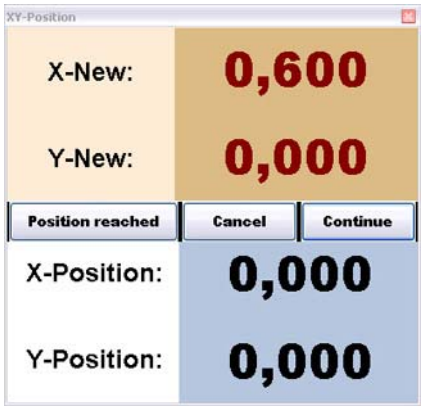
To reset the position of the manual cross slide:

■ Click **Reset** to prepare the software for receiving the reset position signal.

■ Press the K1 key on the micrometers to reset the positions.

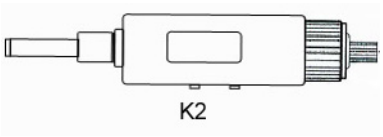


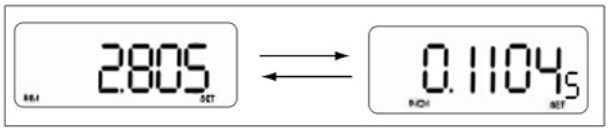
■ Click **Continue** to accept the reset position.



To change the measuring unit on the micrometer display from mm to inch:

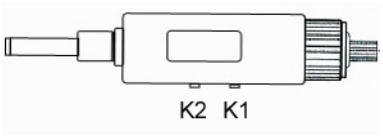
■ Press the K2 key on the micrometers.

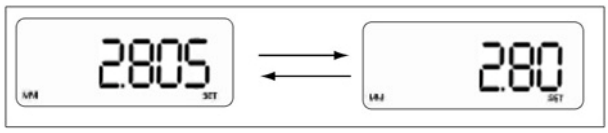




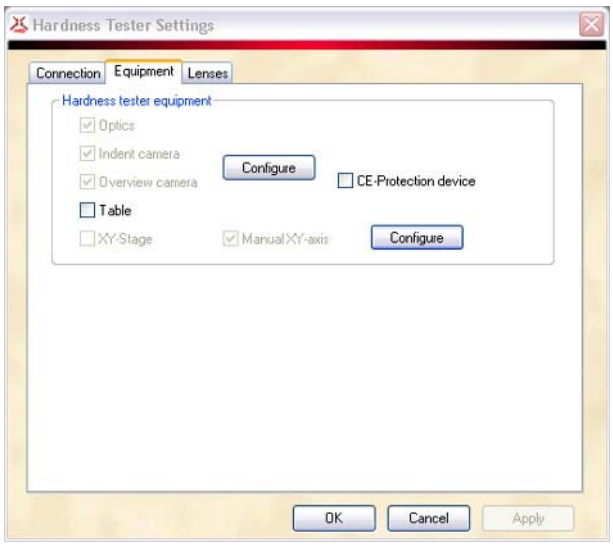
To change the number of decimals to display 1 µm or 10 µm values:

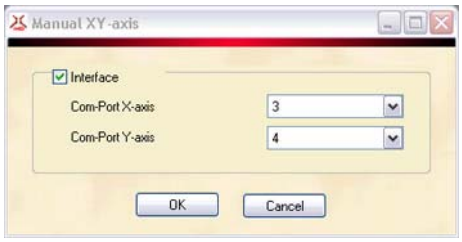
- Press the K1 and K2 keys on the micrometers simultaneously.





NOTE
In order to use the B version with position feedback a PC with 2 free serial ports is needed.
Further, the position feedback has to be enabled in the Manual XY-axis configuration in the *Hardness Tester Settings* window.



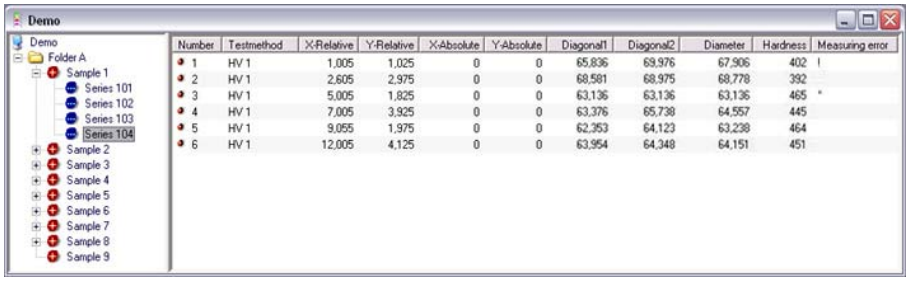


Reading the Measurement Result

During series measurement, the image *Evaluation* window will appear for each individual test point.

Test Specification Window

When the measurement cycle has finished:
The calculated hardness value along with the measured diagonals and the test method is displayed in the *Test Specification* window. Any measurement results that have not been evaluated correctly will be marked with “*” or “!” in the measurement error column, indicating that manual evaluation is necessary.
For more information on re-measuring, please refer to chapter 4, *Measuring a Single Indentation*.



Measurement Value Window

The hardness value of the last measured indent is displayed in the *Measurement Value* window together with the test method.

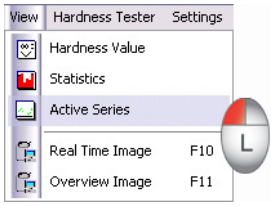
Image Evaluation Window

The *Image Evaluation* window for the last measured indent is still open showing the last measured indentation.

Active Series Window

The *Active Series* window shows graphical information on the measurement result.

Active Series Window



To open the *Active Series* window:

- Select View|Active Series.

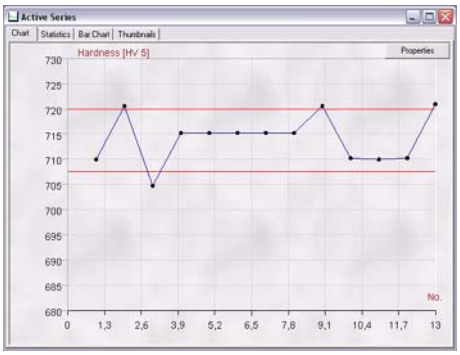
The *Active Series* window contains the following four pages:

- Chart
- Bar Chart
- Statistics
- Thumbnails

Chart

The *Chart* window shows the hardness value of the measured indents.
If surface hardness limits have been defined for the test series, these are included in the chart.

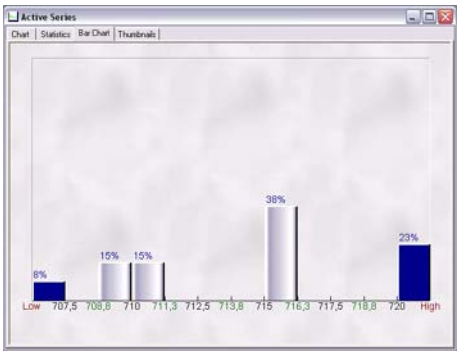
Under *Properties*, the appearance of the scales and the point size can be set.



Bar Chart

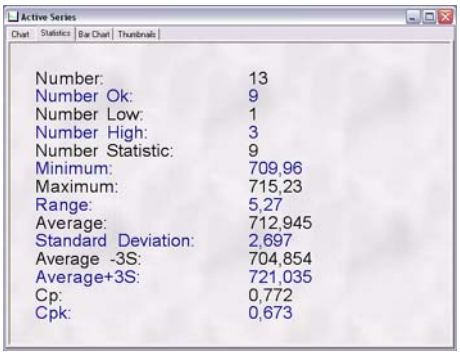
The *Bar Chart* window shows the hardness distribution of the measured indents.

Statistical limits have to be set to enable display of the bar chart.



Statistics

In the *Statistics* window, the total number of measurement and the number of measurements within the statistical limits is shown.

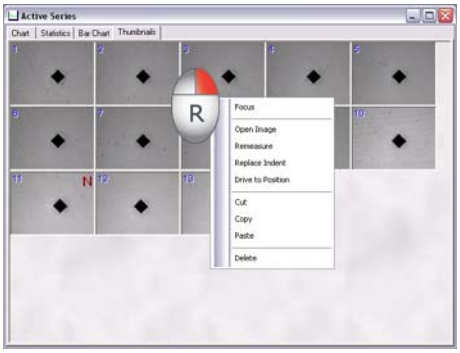


Statistical evaluation is available provided that statistical limits have been defined for the test series.

For more information on Statistics, please refer to chapter 11 *Statistics*.

Thumbnails

In the *Thumbnails* window, thumbnails of the images of the measured indents are shown.



Right clicking on an image will open a context menu; the image can then be opened, re-measured and an indent replaced directly from the *Thumbnails* window.

Re-measured indents are visually marked with a red “N”.

NOTE
A maximum of 125 images are saved per test series.

6. Measuring Case Depth

Case Depth Test Runs

With **ecos** software, case depth test runs are performed easily and reliably. A motorised XY-stage and the Automatic Stop feature saves time and allows for unattended testing.

CHD (Eht)

CHD (Eht) is defined as determination of the effective depth of carburised and hardened cases. The typical CHD limit is 550 HV with HV1 test method.

Rht

Rht is defined as determination of the effective depth of hardening after flame or induction hardening. The typical Rht limit is 80% of the surface hardness with HV1 test method.

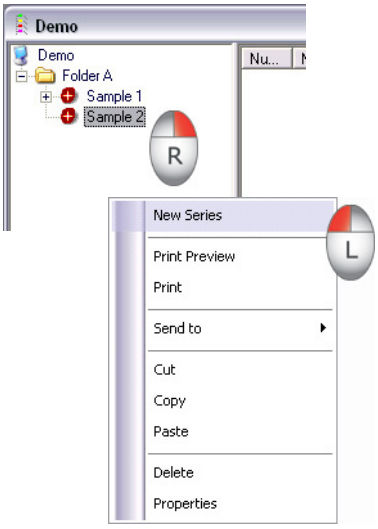
Nht

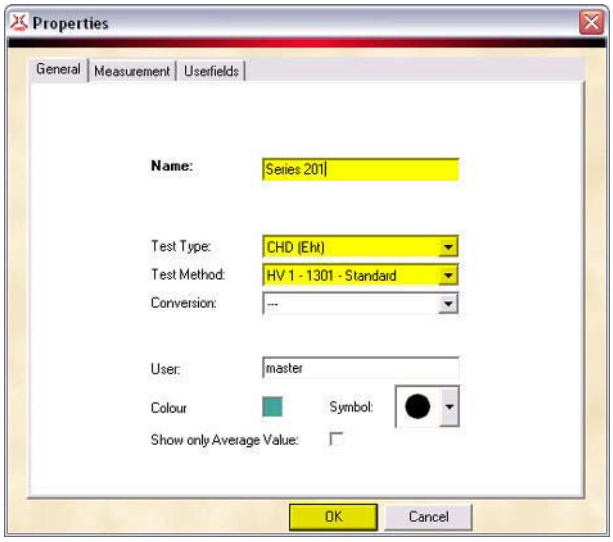
Nht is defined as determination of the effective depth of hardening after nitriding. The typical Nht limit is the actual core hardness +50HV with HV 0.5 test method.

Defining a Case Depth Series

To create a sample and case depth test series:

- Create a new Sample and a new Series as previously described.
- In the *Properties* window, select a case depth method in the **Test Type** drop down list.
- Select a **Test Method**.





Limit Settings

■ Click on the *Measurement* tab to view the measurement settings.

Surface Hardness Limits

Values for the surface hardness limit (Min and Max) can be entered. These will be displayed on the resulting graphics.

Statistical Limits

Values for the statistical limits (Min and Max) can be entered. These limits are usually not relevant for CHD tests.

Case Hardness Depth Limits

Case hardness depth limits in mm can be entered. These will be displayed on the resulting graphics.

Hardness Limit

The hardness limit is the case hardness depth cut-off.

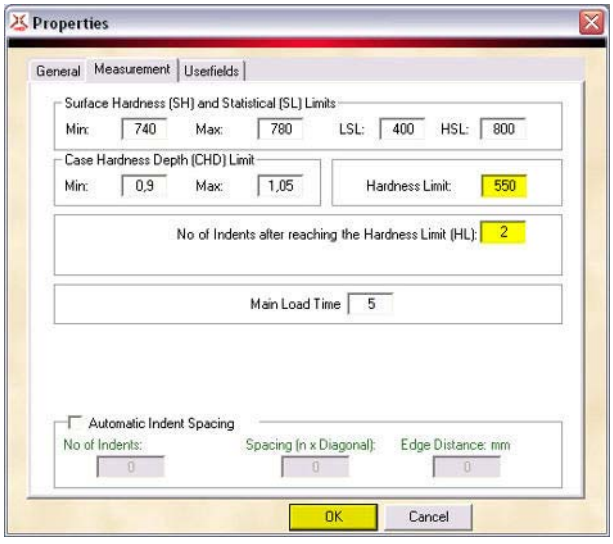
■ Enter a value for the hardness limit, for example 550 HV.

Automatic Stop after Reaching the Hardness Limit

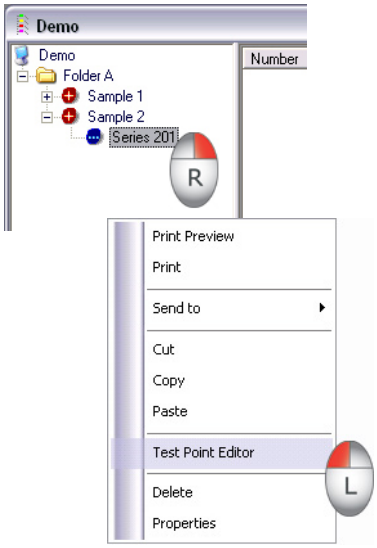
Traditionally a high number of indentations need to be performed to be sure to reach the hardness limit. With **ecos** the number of indents to be performed once the hardness limit has been reached can be defined, stopping automatically regardless of the number of test points that have been set. This saves time and ensures that the hardness limit is reached every time.
To automatically stop the test run when the hardness limit is reached:

■ Enter the number of indents to be performed after reaching the hardness limit, for example 2.

■ Click **OK** to accept the series properties.

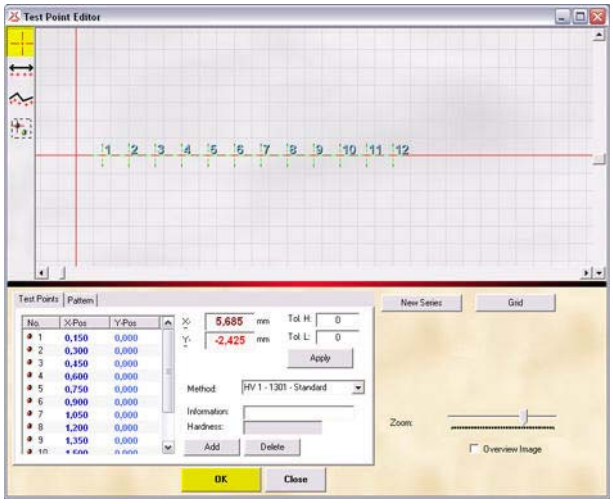


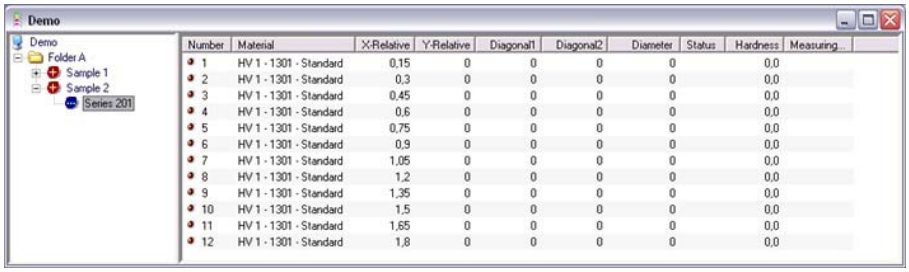
Defining a Test Point Pattern



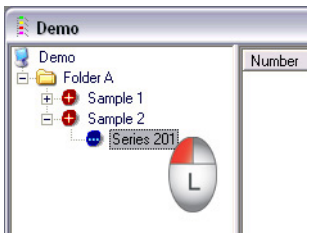
Once a test series has been defined, the test points must be set.
To define a test point pattern:

- Select the measurement series.
- Right mouse click on the measurement series to open the context menu.
- Select *Test Point Editor* to open the *Test Point Editor* window.
- Select test points as described in the previous chapter.
- Click **OK** to submit the test points and close the window.




Demo
Demo
Folder A
Sample 1
Sample 2
Series 201
Number
Material
X-Relative
Y-Relative
Diagonal1
Diagonal2
Diameter
Status
Hardness
Measuring...
1 HV 1 - 1301 - Standard 0,15 0 0 0 0 0,0
2 HV 1 - 1301 - Standard 0,3 0 0 0 0 0,0
3 HV 1 - 1301 - Standard 0,45 0 0 0 0 0,0
4 HV 1 - 1301 - Standard 0,6 0 0 0 0 0,0
5 HV 1 - 1301 - Standard 0,75 0 0 0 0 0,0
6 HV 1 - 1301 - Standard 0,9 0 0 0 0 0,0
7 HV 1 - 1301 - Standard 1,05 0 0 0 0 0,0
8 HV 1 - 1301 - Standard 1,2 0 0 0 0 0,0
9 HV 1 - 1301 - Standard 1,35 0 0 0 0 0,0
10 HV 1 - 1301 - Standard 1,5 0 0 0 0 0,0
11 HV 1 - 1301 - Standard 1,65 0 0 0 0 0,0
12 HV 1 - 1301 - Standard 1,8 0 0 0 0 0,0

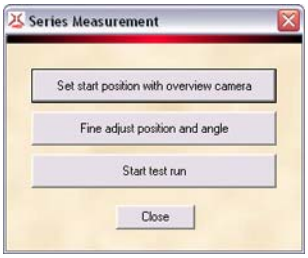
Performing a Case Depth Test Run



Measurements can be started once the test point pattern has been defined for a test series:

- Select the measurement series.

- Click the **Series Measurement** button on the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement*.



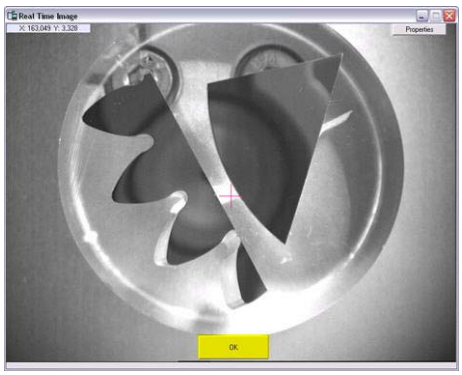
- A dialog window will open with the following options:
  - Set starting point with the overview camera
  - Fine adjust position and angle under the objective lens.
  - Start the test run

PRECONDITIONS
In order to select starting points with the overview camera and utilise the features described below, Duramin-A300 needs to be equipped with an overview camera, and the ecos 2nd Camera software needs to be installed.

Setting a Starting Point with an Overview Camera

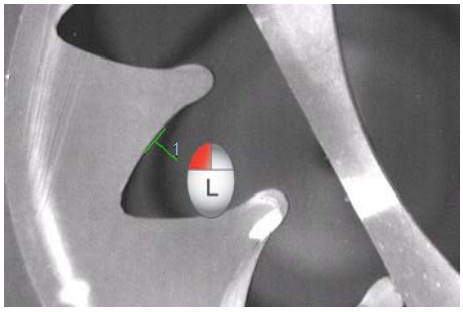
To set the starting point with the overview camera:

- Select **Set start position with overview camera** and the XY-stage will move to the overview camera.
  A new window with a real-time image from the overview camera opens.
- Place the test sample under the overview camera and click **OK**.



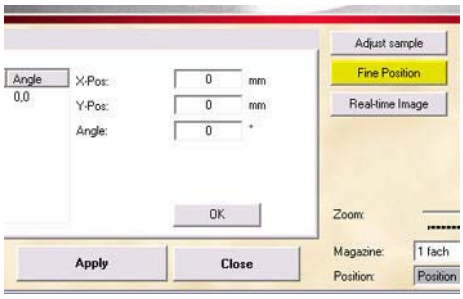
- A digital image opens in the *Set Starting Points* window.
- Click in the image to select the starting point.

- Click on the T-line and click and drag to position and to adjust the angle.



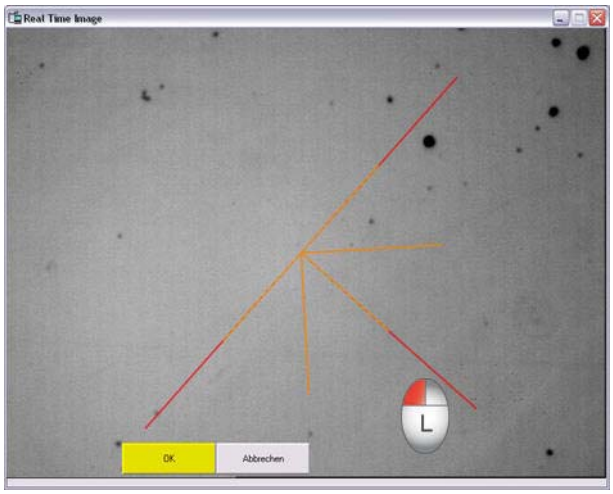
Fine Positioning with the Objective Lens

- Click **Fine Position** to move to the objective lens.

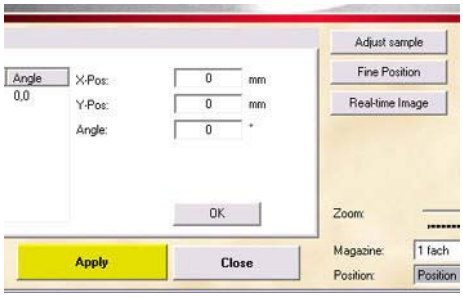


A real-time image of the sample surface opens.

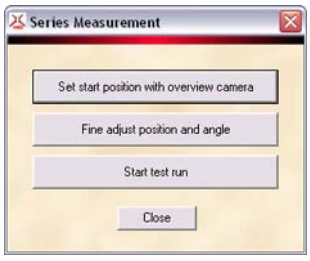
- Use the *XY-stage Control* to move the sample or click and drag in the image to move the XY-stage.
- If necessary, click the T-line and turn to adjust the angle.
- Click **OK** to accept the fine positioning.



■ Click **Apply** in the *Set Starting Points* window to accept the starting point and start the test run.



Setting a Starting Point without an Overview Camera



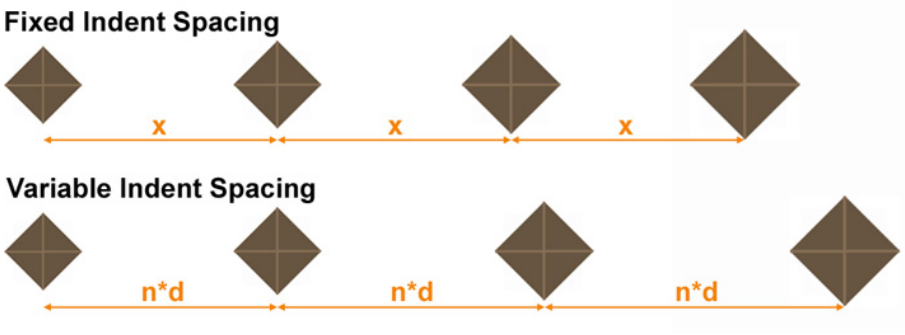
The starting point can also be set without using an overview camera, e.g. if any starting point on the sample edge would be adequate.
To go directly to fine positioning under the objective lens:

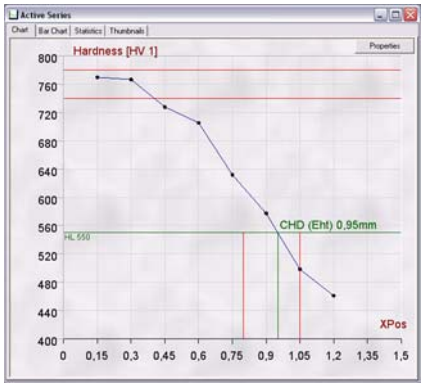
■ Click **Fine adjust position and angle** in the *Series Measurement* dialog window.
■ A real-time image of the sample surface opens.
■ Use the *XY-stage Control* to move the sample or click and drag in the image to move the XY-stage.
■ If necessary, click the T-line and turn to adjust the angle.
■ Click **OK** to accept the fine positioning and start the test run.

Automatic Indent Spacing

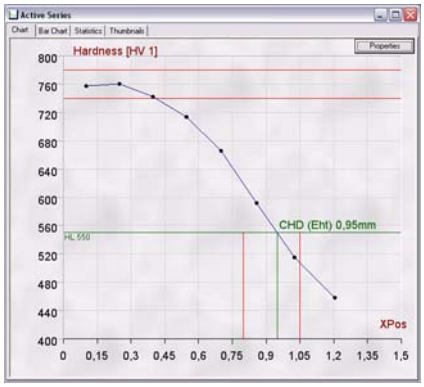
Traditionally a fixed spacing (in µm) between the indents is used when running case depth measurements, regardless of the fact that the size of the indentations changes through the case.

With the unique automatic indent spacing function, **ecos** allows spacing to be set according to actual indentation size (e.g. 3x indentation diagonal). The spacing between each indentation is calculated individually, ensuring that spacing increases as the indentation increases in size. The result is perfectly spaced indentations according to standards.





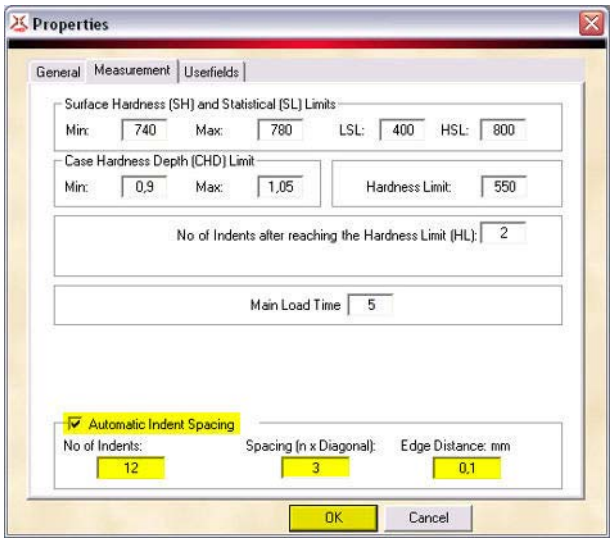
CHD measurement with fixed indent spacing



CHD measurement with variable indent spacing

For automatic indent spacing with **ecos**:

■ In the *Properties* of the test series, tick **Automatic Indent Spacing** in the *Measurement* window.



■ Enter the number of indentations to be performed.
Note: If automatic stop after reaching the hardness limit has been selected, simply enter a high enough value to be sure to reach this limit.

■ Enter the number of diagonals to be set as indent spacing (e.g. 3 to achieve 3x indentation diagonal spacing).

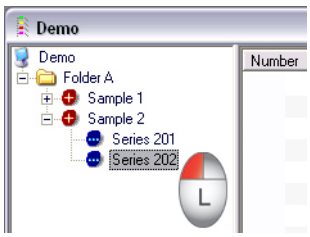
■ Enter the distance from the sample edge (in mm) for the first indent position.

■ Click **OK** to close the *Properties* window.

Performing a Case Depth Test Run with Automatic Indent Spacing

With **Automatic Indent Spacing** selected it is not necessary to define a test point pattern as **ecos** will automatically add indents.
To perform the case depth test run:

■ Select the measurement series.



■ Click the **Series Measurement** button on the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement*.

■ Follow the instructions as described above.

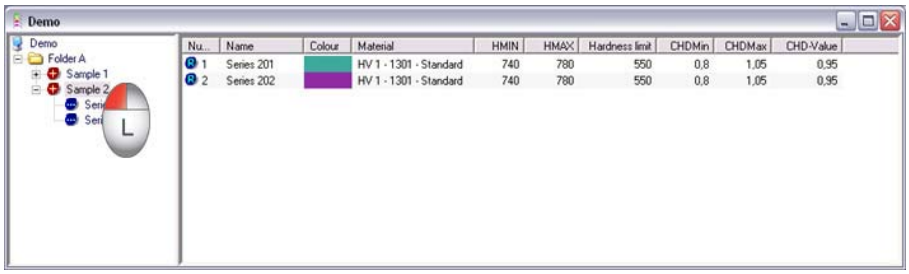
Reading the Measurement Result

When the measurement cycle has finished the calculated hardness of the individual indentations and the CHD value are shown in a number of ways:

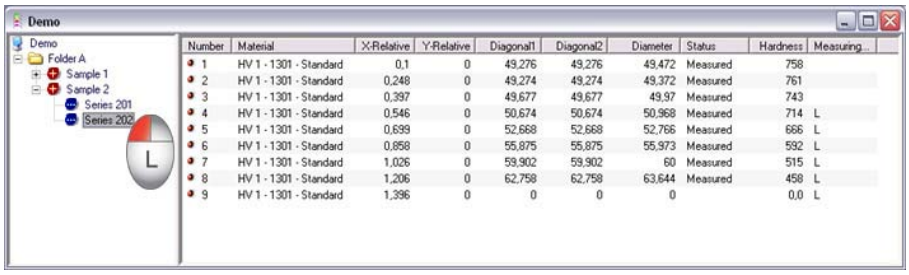
Test Specification Window

In the *Test Specification* window:

- Select the Sample to see the resulting CHD value.



- Select the Series to see the calculated hardness values for the individual indentations along with the measured diagonals.


Demo
Demo
Folder A
Sample 1
Sample 2
Series 201
Series 202
Number
Material
X-Relative
Y-Relative
Diagonal1
Diagonal2
Diameter
Status
Hardness
Measuring...
1 HV 1 - 1301 - Standard 0,1 0 49,276 49,276 49,472 Measured 758
2 HV 1 - 1301 - Standard 0,248 0 49,274 49,274 49,372 Measured 761
3 HV 1 - 1301 - Standard 0,397 0 49,677 49,677 49,97 Measured 743
4 HV 1 - 1301 - Standard 0,546 0 50,674 50,674 50,968 Measured 714 L
5 HV 1 - 1301 - Standard 0,699 0 52,668 52,668 52,766 Measured 666 L
6 HV 1 - 1301 - Standard 0,858 0 55,875 55,875 55,973 Measured 592 L
7 HV 1 - 1301 - Standard 1,026 0 59,902 59,902 60 Measured 515 L
8 HV 1 - 1301 - Standard 1,206 0 62,758 62,758 63,644 Measured 458 L
9 HV 1 - 1301 - Standard 1,396 0 0 0 0 0,0 L

Any measurement results that have not been evaluated correctly will be marked with “*” or “!” in the measurement error column, indicating that manual evaluation is necessary.
For more information on re-measuring, please refer to chapter 4.

Measurement Value Window

The hardness value of the last measured indent is displayed in the *Measurement Value* window together with the test method.

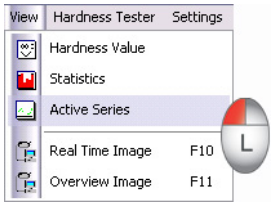
Image Evaluation Window

The *Image Evaluation* window for the last measured indent is still opened showing the last measured indentation.

Active Series Window

The *Active Series* window shows graphical information on the measurement result.

Active Series Window

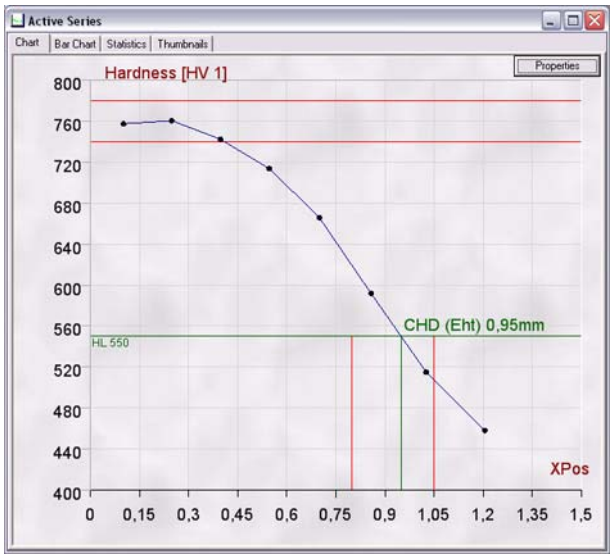


To open the *Active Series* window:
■ Select *View|Active Series*.

The *Active Series* window contains the following four pages:
- Chart
- Bar Chart
- Statistics
- Thumbnails

Chart

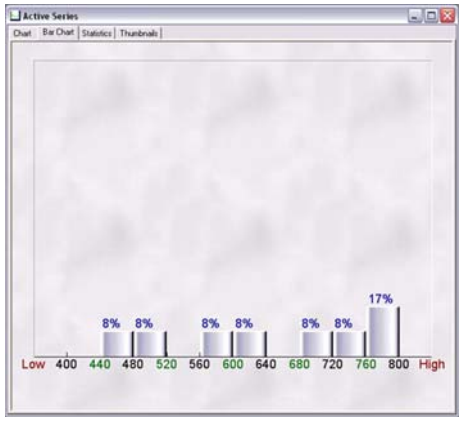
The *Chart* window shows a graph of the hardness values of the measured indents.



The hardness limit (550 HV in this example) and the CHD value are displayed in the chart.
If surface hardness limits (Min and Max) have been defined for the test series, these are included in the chart.
If CHD value limits (Min and Max) have been defined for the test series, these are included in the chart.
Under *Properties*, the appearance of the scales and the point size can be set.

Bar Chart

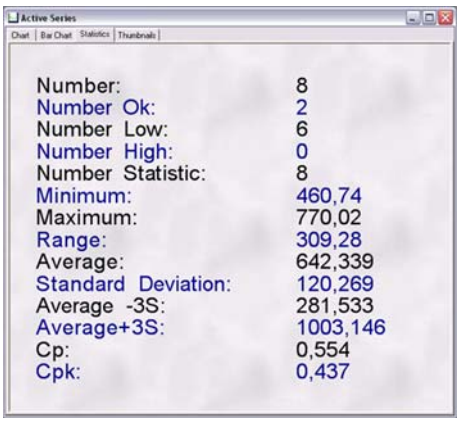
The *Bar Chart* window shows the hardness distribution of the measured indents.
Statistical limits have to be set to enable display of the bar chart.



Statistics

In the *Statistics* window, the number of measurement results within the statistical limits is shown.
Statistical evaluation is available provided that statistical limits have been defined for the test series.

For more information on Statistics, please refer to chapter 11 *Statistics*.

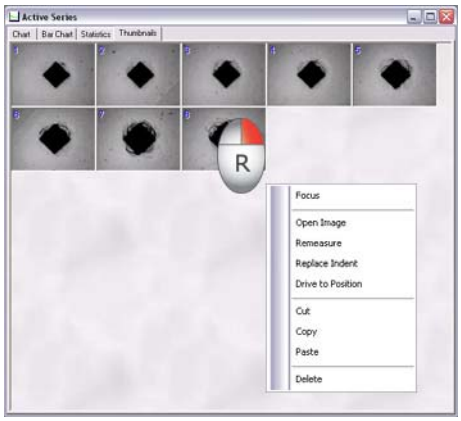


Thumbnails

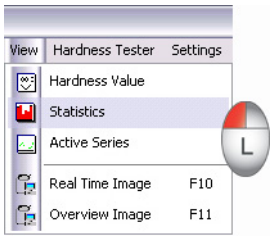
In the *Thumbnails* window, thumbnails of the images of the measured indents are shown.

Right clicking on an image will open a context menu; the image can then be opened, re-measured and an indent replaced directly from the *Thumbnails* window.

Re-measured indents are visually marked with a red “N”.

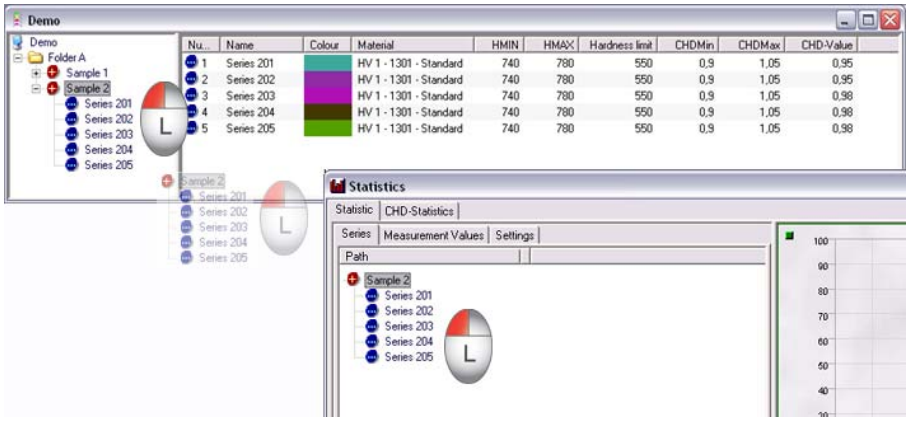


Comparing Multiple Case Depth Series



The *Active Series* window displays the measurement results for a selected series. However, in some cases it is useful to include several series in one chart so that the results can be compared. To include several series:

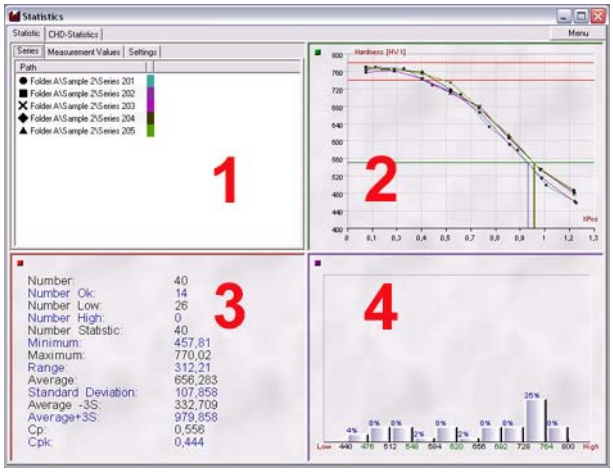
- Select *View*|*Statistics* to open the *Statistics* window.
- Select a sample containing CHD series, or select individual series.
- Drag and drop it in the *Statistics* window.



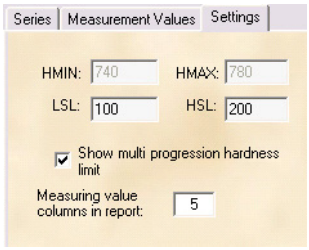
Statistics Window

The *Statistics* window contains 4 sub-windows:

1. *Series* window
2. *Chart* window
3. *Statistics* window
4. *Bar Chart* window



Series window



The *Series* window shows the series selected.

- Click the *Measurement Values* tab to view the individual hardness values.
- Click the *Settings* tab to view the limit settings.
  The surface hardness limits are inherited from the first case depth series.
  The Statistical limits can be set if relevant.
- Tick *Show multi progression hardness limit* to view the case hardness limit on your chart.
  The number of columns in the report can be set here (standard is 5. If changed it might be necessary to change the report template as well).

Chart window

The *Chart* window shows a graphical presentation of the series.

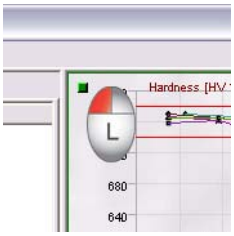
Statistics window

The *Statistics* window shows the statistical evaluations of the measurements.

Bar Chart window

The *Bar Chart* window shows the distribution of measurement values according to upper and lower statistical limits set.

Multiple Graphs



To enlarge a window:

- Click the small, upper left box to enlarge.
- Click the upper left box again to close the window.

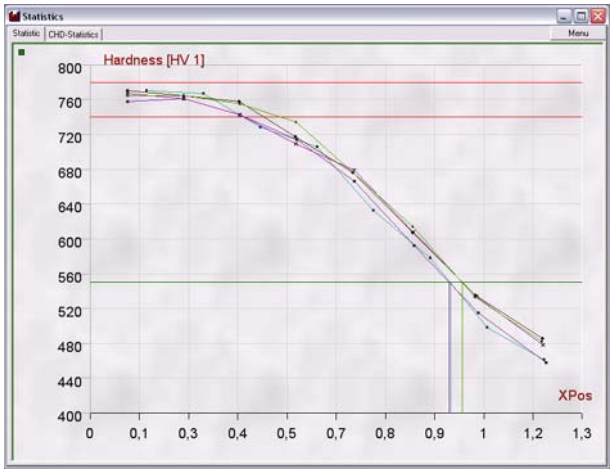
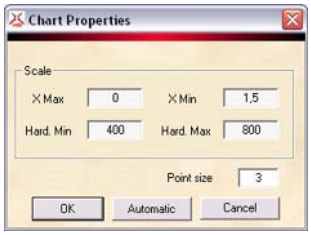


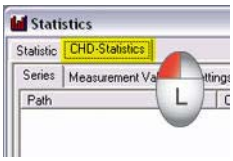
Chart Properties

To change the chart settings:

- Right click in the chart to open the *Chart Properties* window.

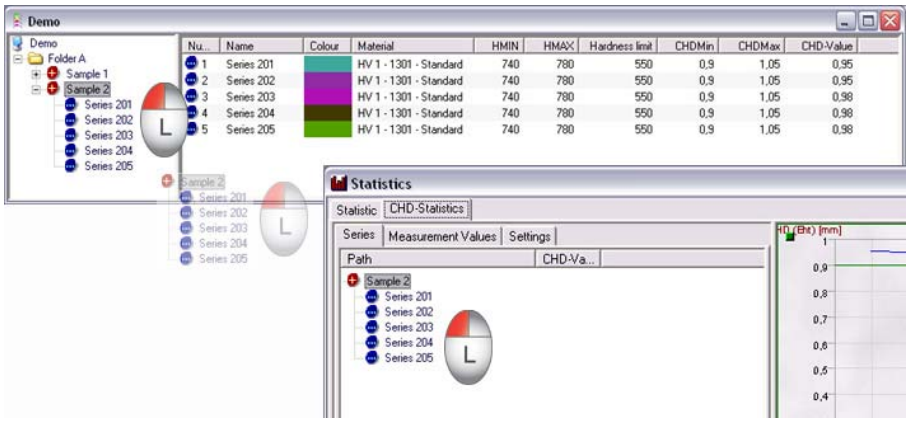


CHD Statistics

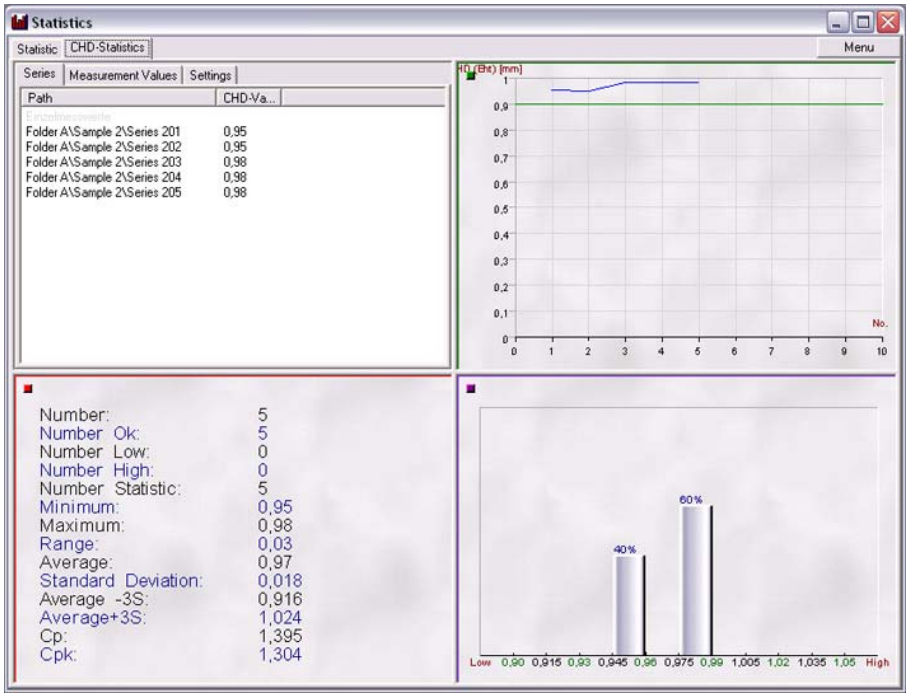


To display statistics on the CHD values:

- Select the *CHD-Statistics* tab in the *Statistics* window.
- Select a sample containing CHD series, or select individual series.
- Drag and drop it in the *CHD-Statistics* window.



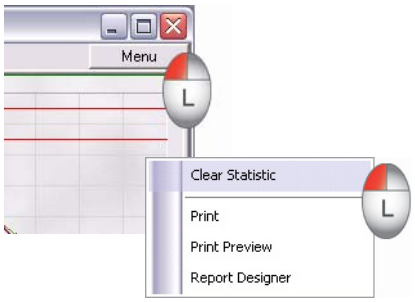
The *CHD-Statistics* window also contains 4 sub-windows. Here the graphics and statistics are related to the CHD-values instead of the individual hardness measurements.



Clear Statistics

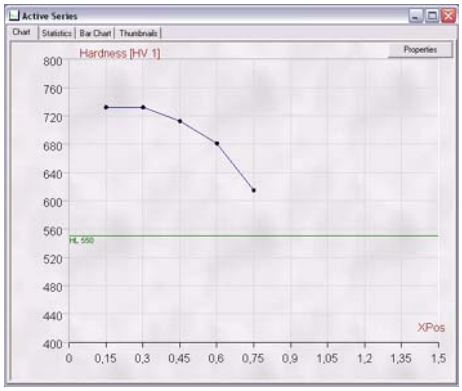
To clear the *Statistics* window or the *CHD-Statistics* window:

- Click the **Menu** button in the upper right corner.
- Select *Clear Statistic*.

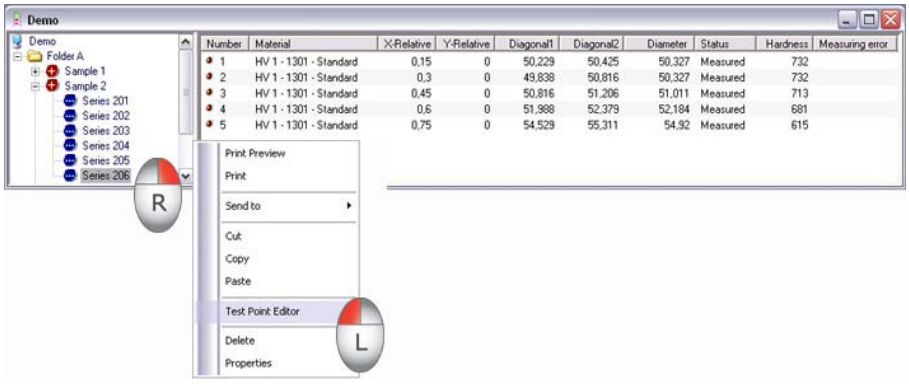


Too Few Indents to Reach Case Depth Limit

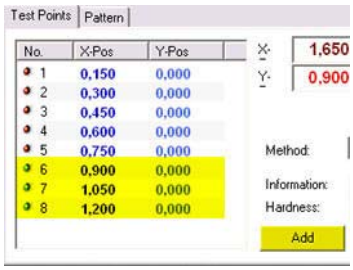
If too few test points have been set to reach the case depth limit:



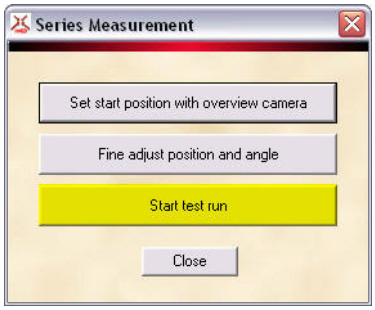
- Select the measured series and open the *Test Point Editor.*



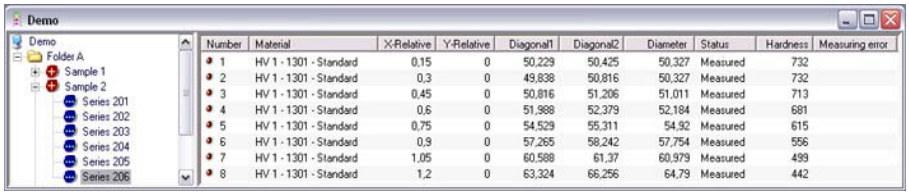
- Add new test points and if necessary click the **X-Pos**. header to sort the test point order as previously described.

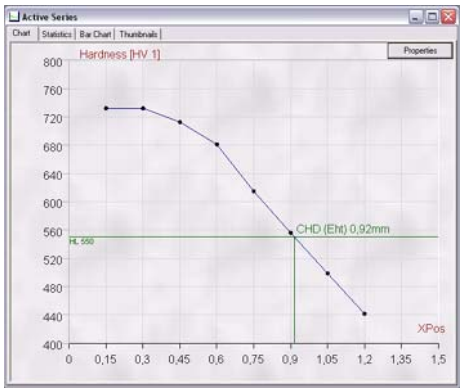


- Click **OK** to close the *Test Point Editor*.
- Click the **Series Measurement** button on the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement*.



- In the opened dialog box, click **Start test run** to start the test run and measure the added indentations.
- The *Test Specification* window and the *Active Series* will be updated to include all measurements.


Demo
Demo
Folder A
Sample 1
Sample 2
Series 201
Series 202
Series 203
Series 204
Series 205
Series 206
Number Material X-Relative Y-Relative Diagonal1 Diagonal2 Diameter Status Hardness Measuring error
1 HV 1 - 1301 - Standard 0,15 0 50,229 50,425 50,327 Measured 732
2 HV 1 - 1301 - Standard 0,3 0 49,838 50,816 50,327 Measured 732
3 HV 1 - 1301 - Standard 0,45 0 50,816 51,206 51,011 Measured 713
4 HV 1 - 1301 - Standard 0,6 0 51,988 52,379 52,184 Measured 681
5 HV 1 - 1301 - Standard 0,75 0 54,529 55,311 54,92 Measured 615
6 HV 1 - 1301 - Standard 0,9 0 57,265 58,242 57,754 Measured 556
7 HV 1 - 1301 - Standard 1,05 0 60,588 61,37 60,979 Measured 499
8 HV 1 - 1301 - Standard 1,2 0 63,324 66,256 64,79 Measured 442



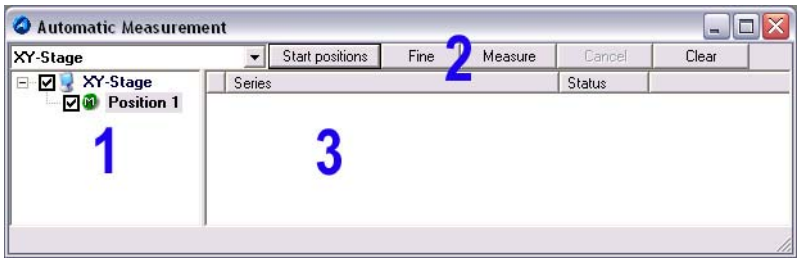
7. Automatic Measurement of Multiple Series

The Automatic Measurement function allows a number of selected test series to be run automatically. This saves time since a number of series can be defined in advance.

PRECONDITIONS
In order to run test series automatically, Duramin-A300 needs to be equipped with a motorised XY-stage.

Automatic Measurement Window

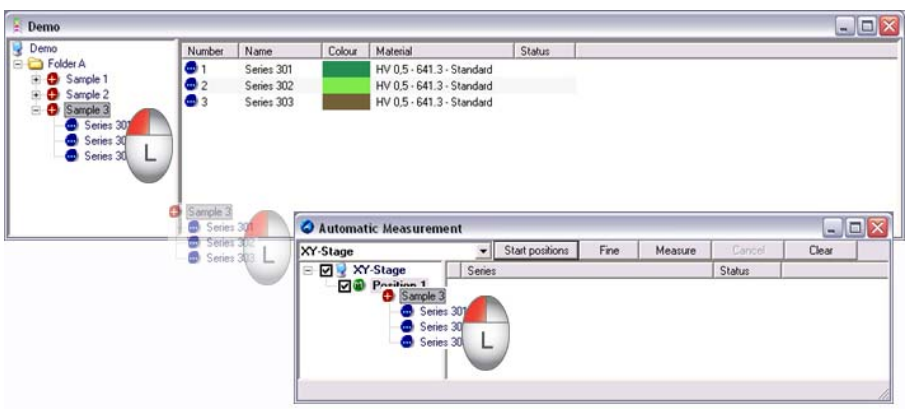
The *Automatic Measurement* window is divided into three areas:
1. Magazine positions
2. Command buttons
3. Test series



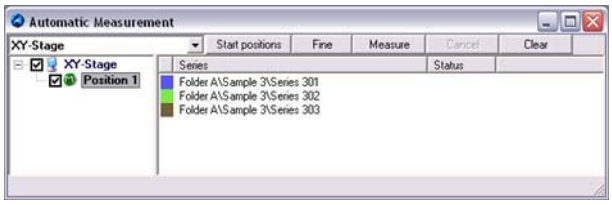
Adding Series

To set up automatic measuring of series:

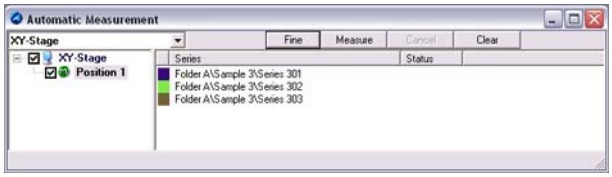
- Create test series and test points as previously described.
- Click the **Automatic Measurement** button in the tool bar or select *Measure|Automatic Measurement*.
  The *Automatic Measurement* window opens.
- From the *Test Specification* window drag and drop the series to be measured to the XY-Stage position in the *Automatic Positions* window.
- To add all test series in a sample to the *Automatic Measurement* window, simply select the sample and drag and drop it to the *Automatic Measurement* window.



The test series selected have now been added for automatic measuring.



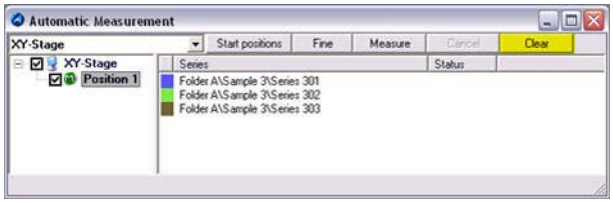
Note: The **Start Positions** button will not be available on hardness tester without overview camera.



Removing Series

To remove test series:

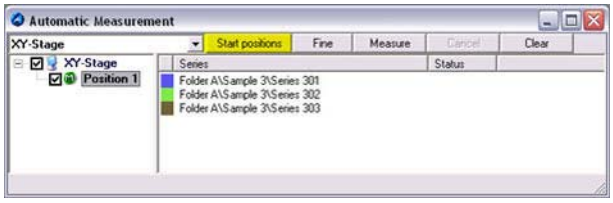
- Select the series to be removed.
- Press the <Delete> key.
- To remove all series, click the **Clear** button.

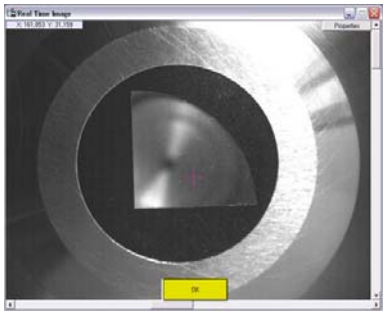


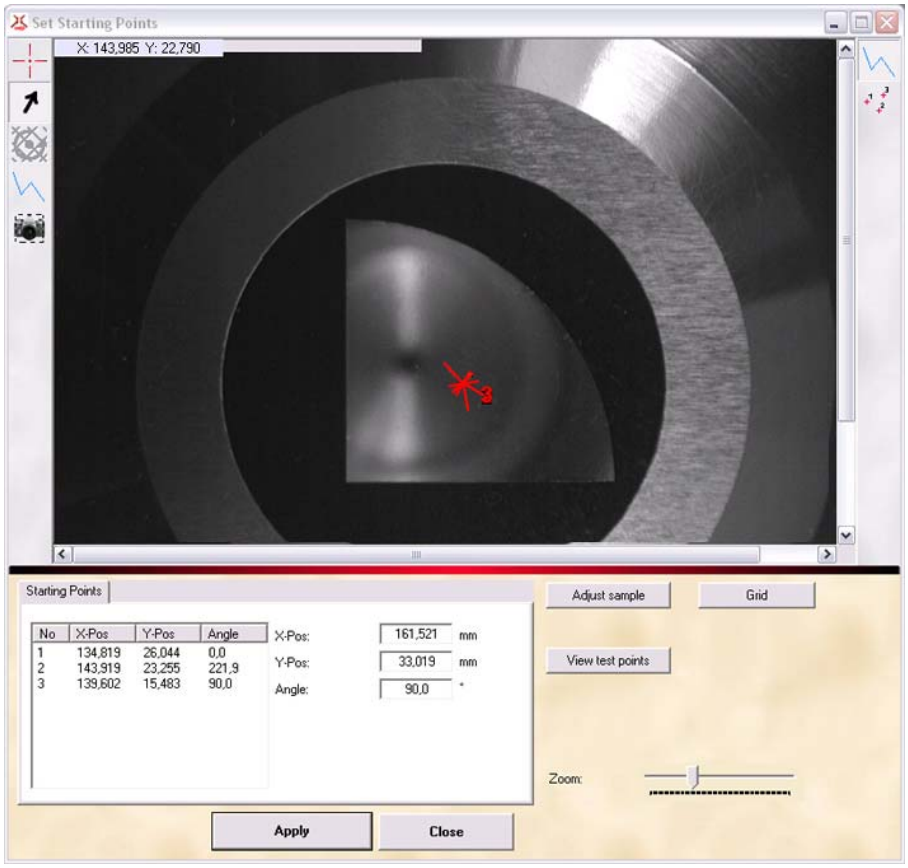
Defining Start Positions

If the test series contain test points with relative position coordinates e.g. if they have not been set via the overview camera, start positions for each series must be defined prior to measuring.
To define the start position of each series using the overview camera:

- Click the **Start positions** button.
- The XY-stage will move to the overview camera.
- A real-time image of the overview camera will open. Click **OK** to accept.
- A digitalised image now opens in the *Set Starting Points* window with the series included.



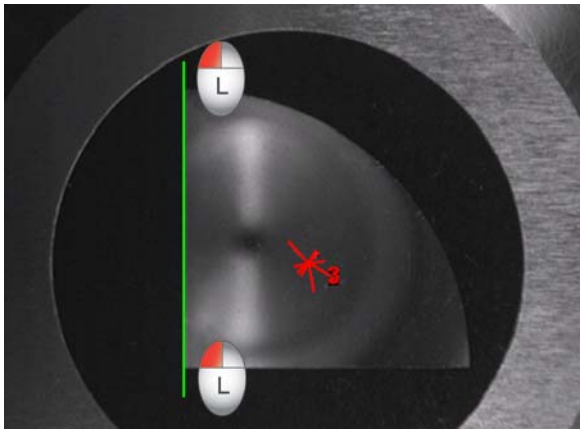




Adding Help Lines

Help lines can be added to facilitate positioning of the test series.

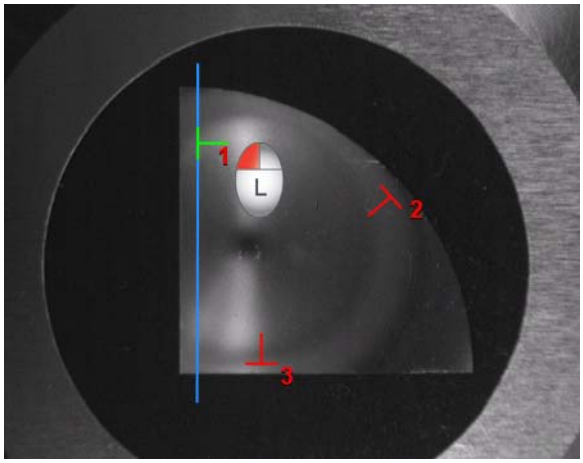
- Select the **Help Line** tool.
- Left mouse click in the image to set the starting point of the help line and then left mouse click where the help line is to end. Left mouse click again in the image to continue, or right mouse click to end the line.
- A *Help line* dialog box opens and a line offset can be set if required. Click **OK** to accept.



Moving Test Point Patterns

Move each test point pattern in place:

- Select the ***Move and Turn T-line*** tool and click and drag each individual test point pattern into place and turn the T-line to adjust the angle.



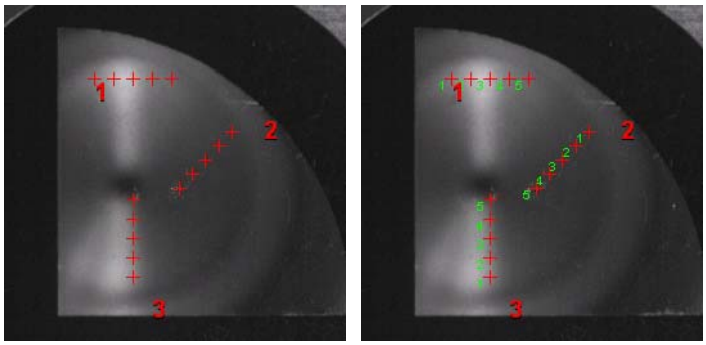
Viewing Test Points

The T-lines represent test points patterns e.g. numerous test points. To view the individual test points:

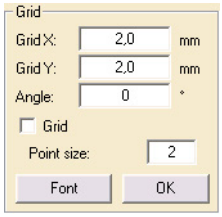
- Click the **View test points** button in the *Starting Points* window.

Viewing Test Point Numbering

- To view the numbering of the individual test points click the **Show test point no.** tool.



Editing Font and Point Size



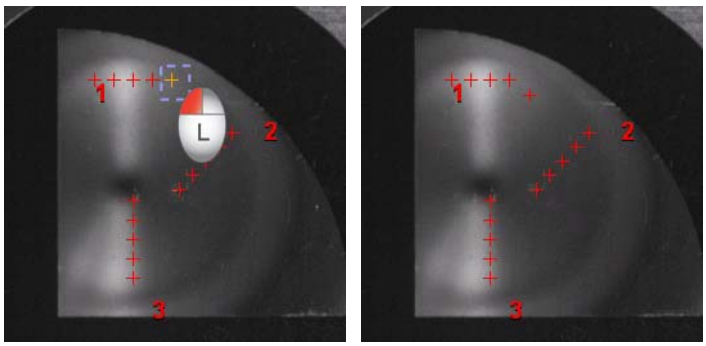
The font, colour and size and the point size can be edited:

- Click the **Grid** button to open the settings box.
- Enter a test point size.
- Click **Font** and select *Series* to edit the font for the test point pattern or *Indents* to edit the font for the individual test points .

Moving Individual Test Points

Individual test points within the test point pattern can be moved:

- Select the **Select and Move** tool.
- Mouse click and drag to select the test points to be moved.
- Click and drag to move the selected points.



Deleting Individual Test Points

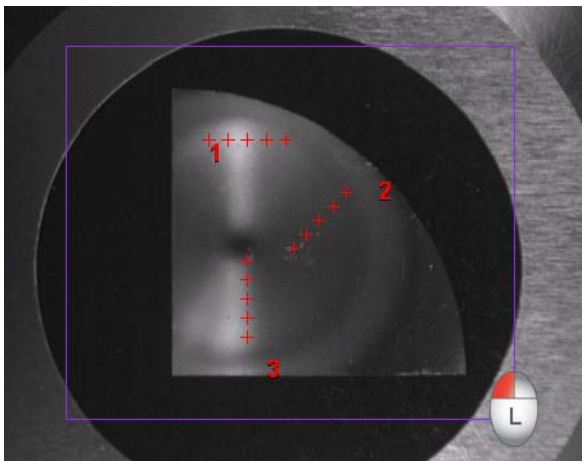
If individual test points are to be deleted:

- Select the **Select and Move** tool.
- Mouse click and drag to select the test points to be deleted.
- Press <Delete>.

Saving an Overview Image

The overview image of the sample, including test points or test point pattern, help lines etc. can be saved and included in a report.
To save an image:

- Select the **Select and save region** tool.
- Mouse click and drag to select the part of the image to be saved.
- Release the mouse to save the selected region.



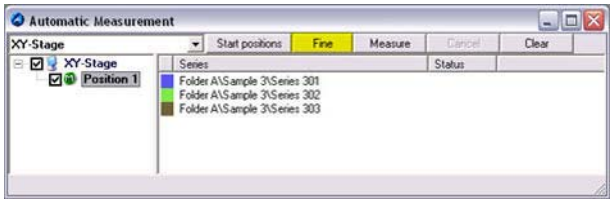
- Click **Apply** to accept the starting positions.

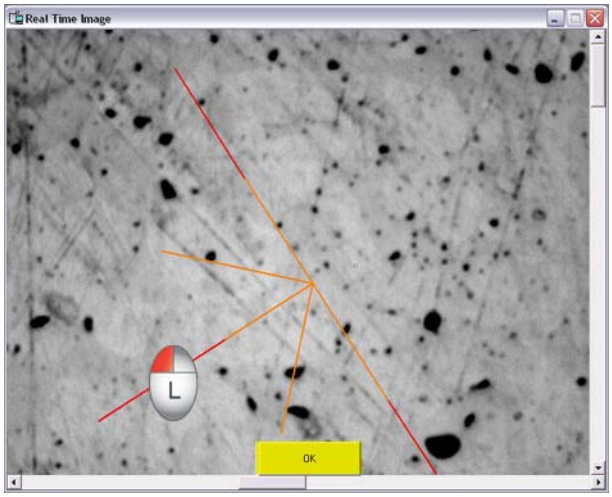
PRECONDITIONS
In order to select starting points with the overview camera, Duramin-A300 needs to be equipped with an overview camera, and the ecos 2nd Camera software needs to be installed.

Fine Adjustment of Positions

To define the start position and angle of each series using the objective lens or to fine adjust the starting positions:

- Click the **Fine** button.
- The XY-stage will move to the objective lens.
  A real-time image of the sample surface will open.
- Use the *XY-Stage Control* to move the sample or click and drag in the image to move to the desired position.
- Click the red lines on the T-line to adjust the angle of the T-line.
- Click **OK** to accept.
- Repeat for each series.

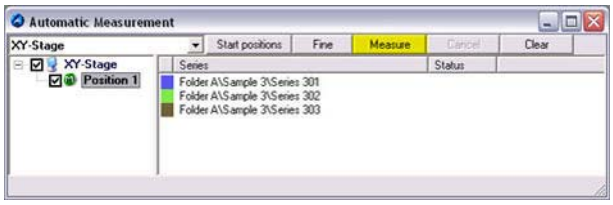




Performing Multiple Series Measurements

Once the start positions have been determined, automatic measurement of all series set up can be started.
To start the test run:

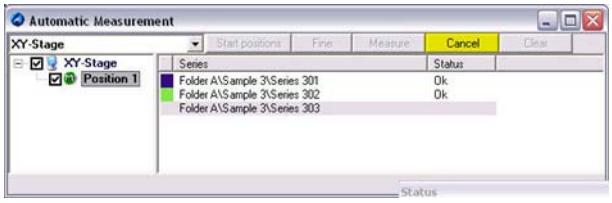
- Click the **Measure** button.



Aborting Automatic Measuring

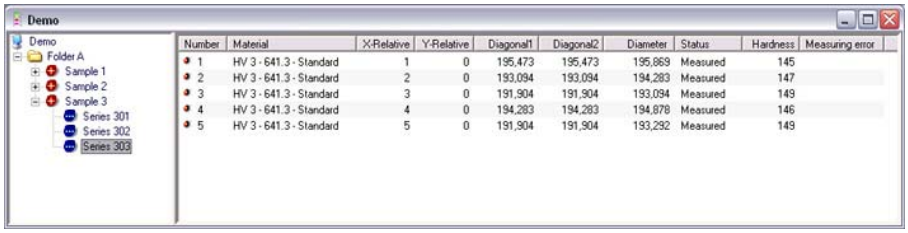
During measuring the status of the automatic measuring is shown in the *Automatic Measurement* window.

- To abort automatic measurement, click the **Cancel** button.



Automatic Measurement Finished

After the automatic measurements have finished the results are shown in the *Test Specification* window and the *Automatic Measurement* window is emptied.

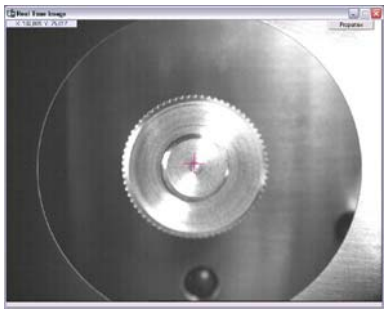

Demo
Demo
Folder A
Sample 1
Sample 2
Sample 3
Series 301
Series 302
Series 303
Number
Material
X-Relative
Y-Relative
Diagonal1
Diagonal2
Diameter
Status
Hardness
Measuring error
1 HV 3 - 641.3 - Standard 1 0 195,473 195,473 195,869 Measured 145
2 HV 3 - 641.3 - Standard 2 0 193,094 193,094 194,283 Measured 147
3 HV 3 - 641.3 - Standard 3 0 191,904 191,904 193,094 Measured 149
4 HV 3 - 641.3 - Standard 4 0 194,283 194,283 194,878 Measured 146
5 HV 3 - 641.3 - Standard 5 0 191,904 191,904 193,292 Measured 149

8. Automatic Measurement on Multiple Samples

The Automatic Measurement function described in the previous chapter also allows tests of multiple series on multiple samples to be run automatically e.g. samples in multiple sample holders (magazines).

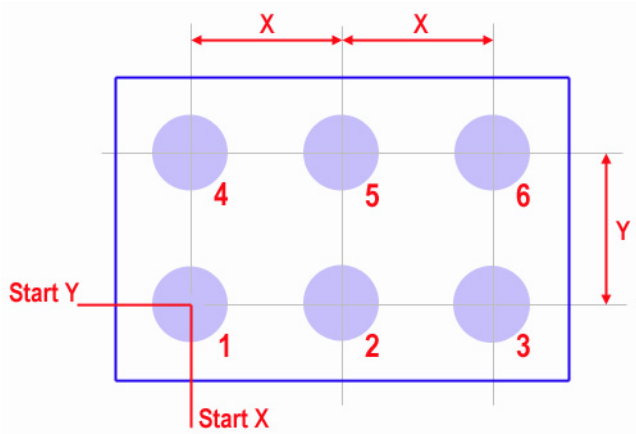
PRECONDITIONS
In order to run test series on multiple samples automatically, Duramin-A300 needs to be equipped with a motorised XY-stage and the ecos Multiple Specimens software module needs to be installed.

Multiple Sample Holders

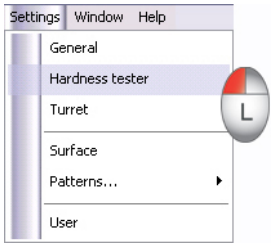


In order to be able to select sample positions, the positions of the samples in the multiple sample holder /magazines have to be defined in ecos.

- Start by placing the sample holder on the Duramin-A300 and use the XY-Stage control to move to the centre of the first hole under the overview camera and determine the Start X and Start Y positions.
  For hardness tester without an overview camera, determine the Start X and Start Y positions under the objective lens then measure the distance between the centres of the holes on the sample holder.

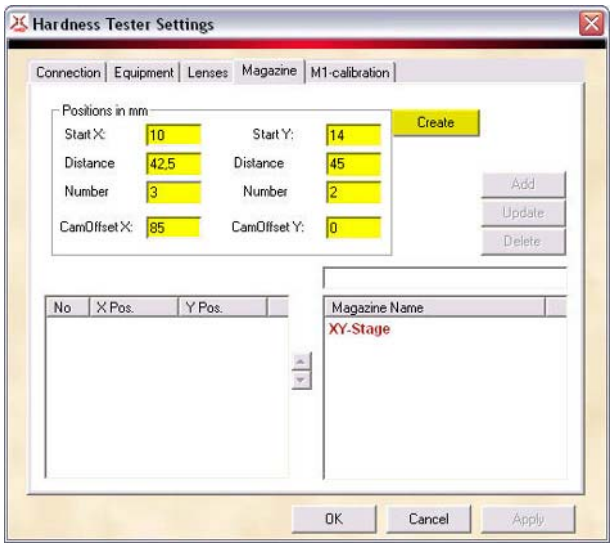


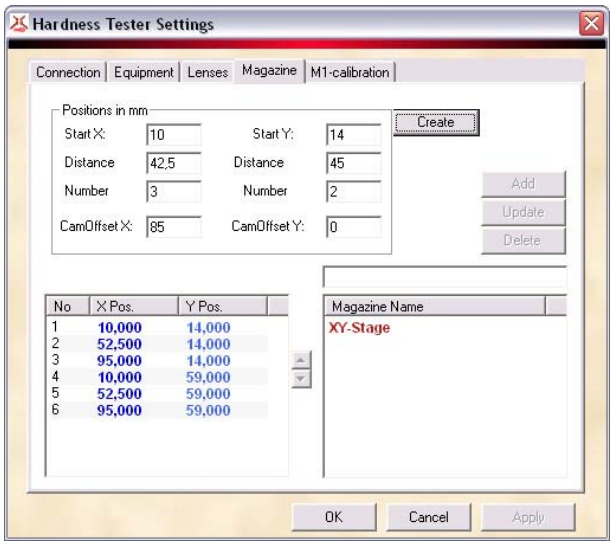
Defining Sample Positions



To define the positions of the sample holder:

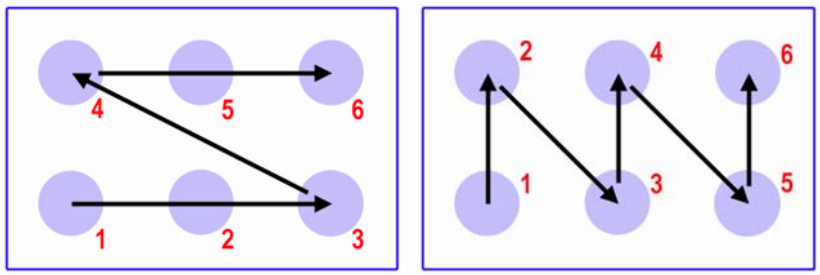
- Select *Settings|Hardness Tester* and open the *Magazine* tab.
- Enter the **Start X** and **Start Y** positions for the first position.
- Enter the distance between each position in the X and Y directions.
- Enter the number of positions in the X and Y directions.
- Enter the offset (distance) between the overview camera and the objective lens (approx. 85 mm in X direction).
- Click **Create** to create the coordinates for all positions.





Editing the Position Sequence

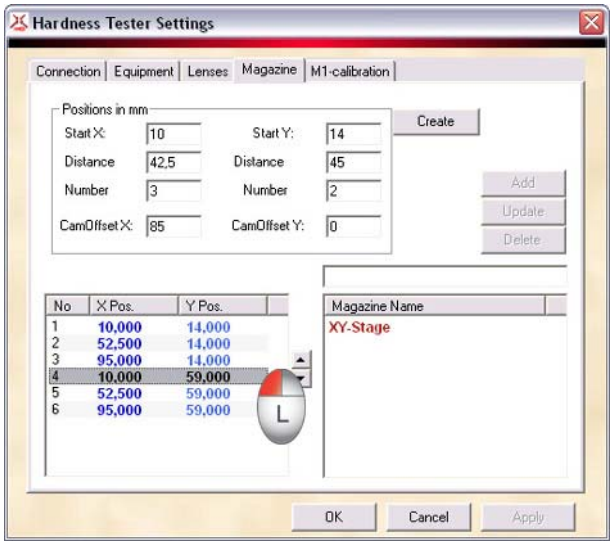
The sequence in which the samples in the holder are tested can be optimised.

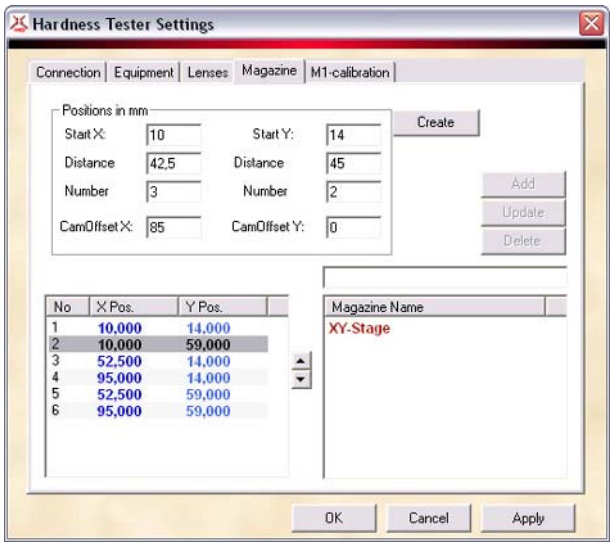


Default sequence *Alternative sequence*

To edit the sequence of the positions:

- Select a set of position coordinates.
- Click on the up and down arrows in the window to move the coordinates to a new position.

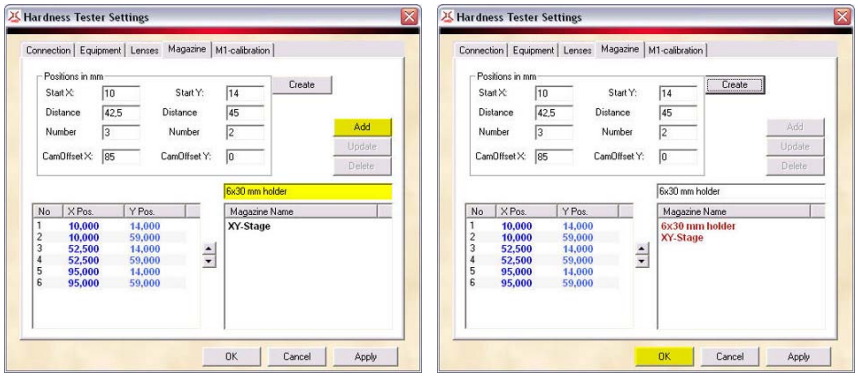




Saving the Sample Holder Settings

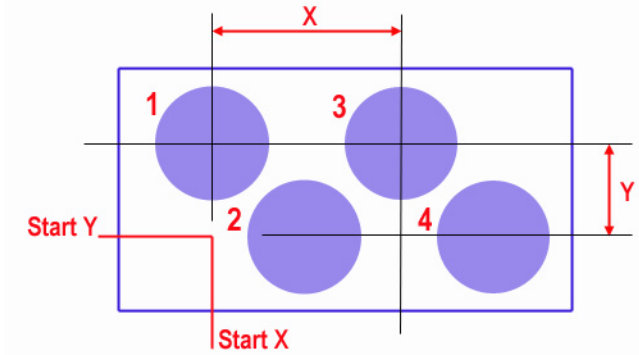
To save the sample holder settings:

- Enter a name for the sample holder.
- Click **Add** to add the sample holder to the list of holders and click **OK** to accept and close the *Hardness Tester Settings* window.



Asymmetrical Sample Holders

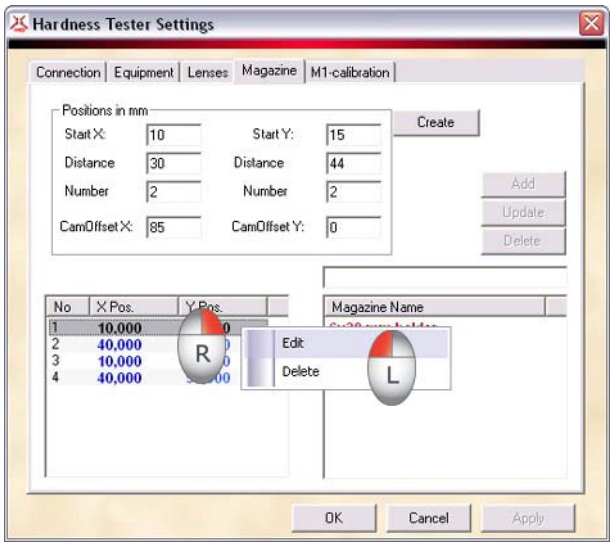
If the positions in the sample holder are not symmetrical, the individual coordinates can be edited to fit the sample holder design.



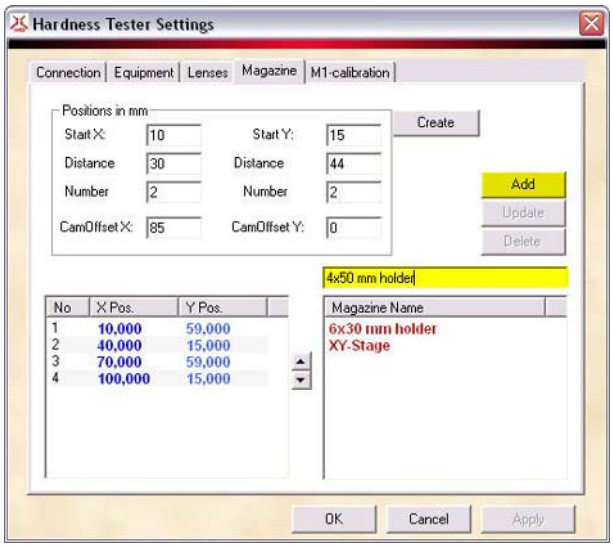
To define an asymmetrical sample holder:

- Enter the lowest starting X and Y coordinates and the distances and number of sample positions and create the position coordinates.

- Right click on the position coordinates to be edited and select **Edit**.



- A *Position* dialog box opens. Enter the correct coordinates and click **OK**.
- If necessary, alter the sequence of the positions as described above.
- Enter a name for the sample holder and click **Add** to save the sample holder settings.



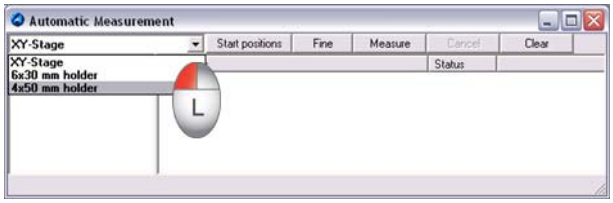
- Click **OK** to accept and close the *Setting* window.

Performing Automatic Measurement on Multiple Samples

With the multiple sample holders defined, automatic measurement of multiple series on multiple samples can be set up:

- Create test series and test points as previously described.
- Click the **Automatic Measurement** button in the tool bar or select *Measure|Automatic Measurement*.
  The *Automatic Measurement* window opens.
- In the drop down list, select a multiple sample holder.

Selecting a Sample Holder

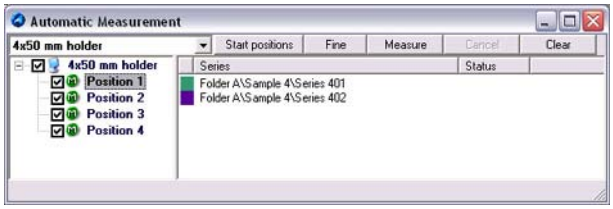


Selecting Sample Positions

- Tick the sample holder positions to be used.

Adding a Test Series

- From the *Test Specification* window drag and drop the series to be measured to the individual sample holder positions in the *Automatic Positions* window.



Removing a Test Series

To remove test series:

- Select the series to be removed.
- Press the <Delete> key.
- To remove all series, click the **Clear** button.

Starting Measurement

Follow the instructions from the previous chapter to set start positions, fine adjust positions and start measuring.

9. Automatic Measuring using Templates

In addition to the automatic measuring functions, **ecos** enables templates for testing of multiple similar samples to be defined.

Working with Templates

Templates are pre-defined combinations of:

- Magazines / sample holders
- Test points patterns
- Placement of the test points pattern on the sample
- Help lines that facilitate correct placing of the template on the sample

When performing repeated tests on similar samples, the template function offers several benefits:

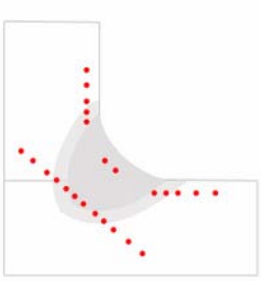
- Templates automatically generate directories, samples and test series when run
- Failures due to incorrect selection of test method etc. are eliminated
- Set-up time is reduced to a minimum saving operator time
- Templates simplify the user interface and let less experienced operators perform sophisticated test runs

PRECONDITIONS
In order to run test series on multiple samples automatically, Duramin-A300 needs to be equipped with a motorised XY-stage and ecos Multiple Specimens software module installed.

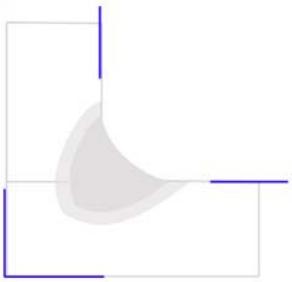
How Templates Work

The Templates function can be utilised in a number of ways, some examples are shown in this chapter.
The principle is that the main tasks in the test procedure are pre-defined and re-used for increased automation.

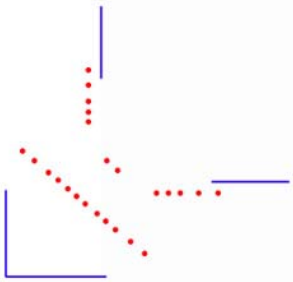
A template to be used with a specific magazine could be defined as follows:



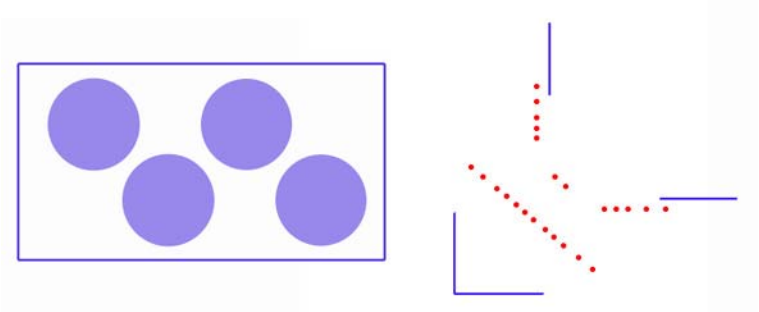
Create a test point pattern



Draw help lines for correct placing on the sample

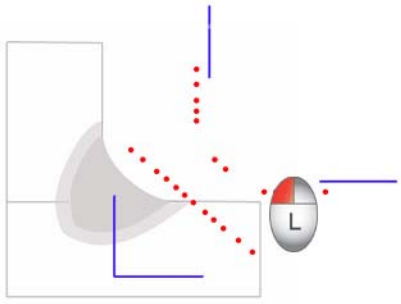


Save them together as a placing pattern

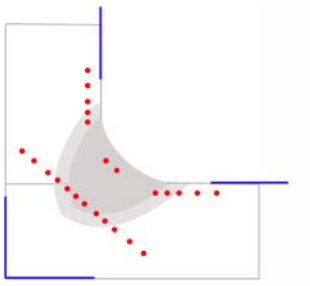


Save the combination of a magazine and the placing pattern as a template.

To perform a test, simply select the template and on each sample run drag the placing pattern in place to start measuring.



Click and drag the pattern in place



Everything is set for measuring

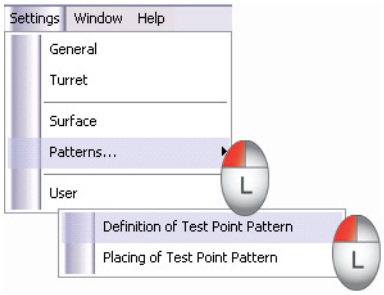
Templates always include a specified magazine and can but do not necessarily include placing patterns or test point patterns.

Creating Magazines

Magazines or sample holders need to be defined for automatic measuring using templates. However, a magazine could in its simplest form just be a specific position on the XY-stage.
For information on *how to define magazines or sample holders*, please refer to the previous chapter.

Creating a Test Point Pattern

A test point pattern is a number of test points saved with relative position coordinates.
To create a test point pattern:

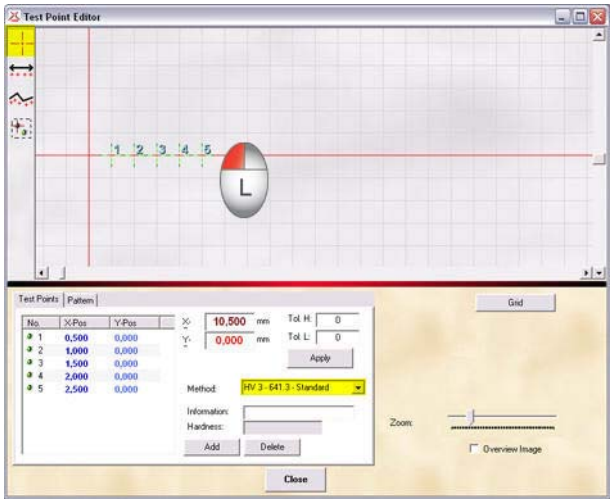


- Select *Settings|Patterns|Definition of Test Point Pattern* to open the *Test Point Editor* window.
- Create test points either by clicking directly in the test point chart or by using the overview camera.

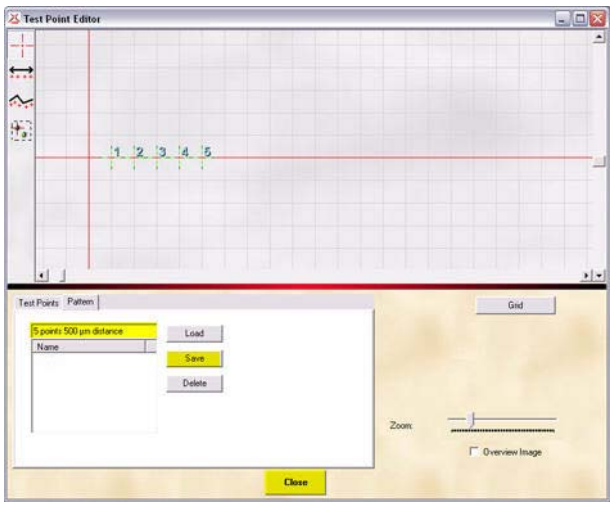
Test Point Chart

To create a test point pattern in the chart:

- Select a method for the test points from the drop down list.
- Simply click in the chart to set test points or use the line tools.



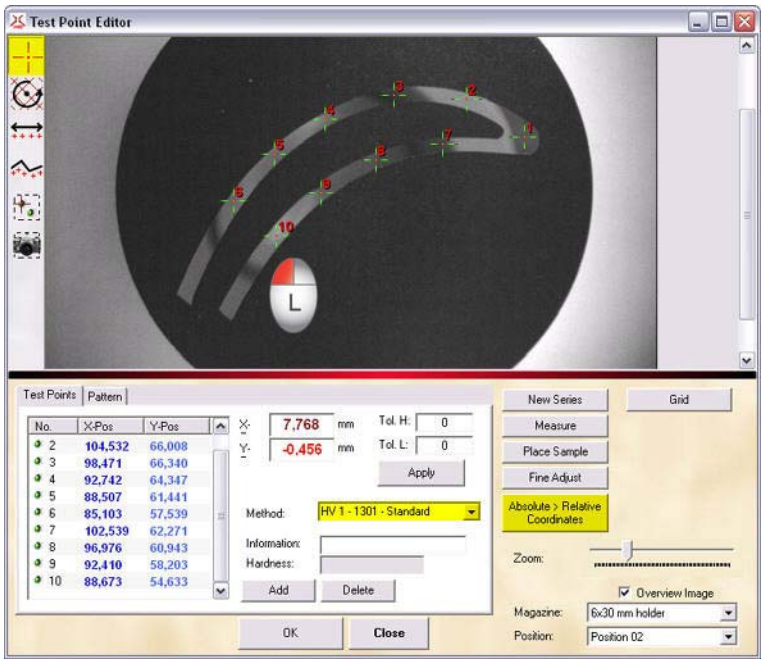
- Click the *Pattern* tab and enter a name for the test point pattern.
- Click **Save** and **Close** to accept and close the *Test Point Editor* window.



Using the Overview Camera

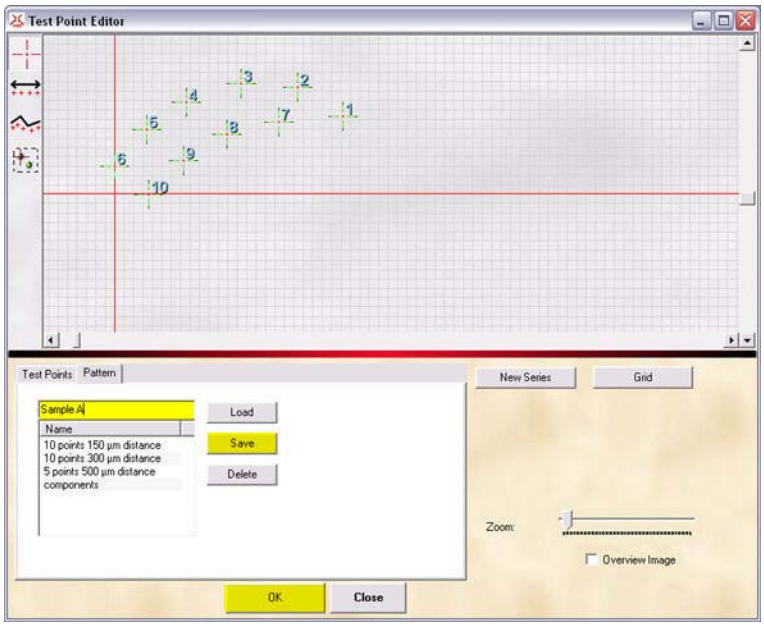
To use the overview camera to set test points:

- Tick **Overview Image** in the *Test Point Editor* window to open a real-time image of the sample.
- Place the sample under the overview camera and click **OK**.
- Select a method for the test points from the drop down list.
- In the digitalised image in the *Test Point Editor,* mouse click to set test points or use the line tools.
- Click **Absolute > Relative coordinates** to convert the absolute positions to relative positions.



- Click the *Pattern* tab and enter a name for the test point pattern.

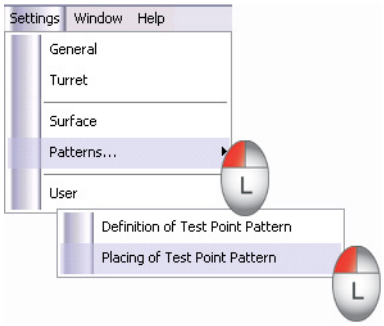
■ Click **Save** and **OK** to accept and close the Test Point Editor window.



NOTE

It is important to convert the absolute position coordinates into relative coordinates since the test point pattern is going to be used on numerous samples placed in different positions.

Creating a Placing Pattern



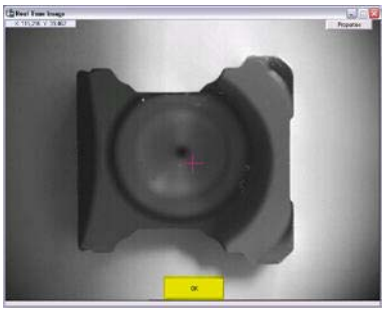
A placing pattern defines the placing of the test point pattern on a sample.
To create a pattern for the placing of the test points:

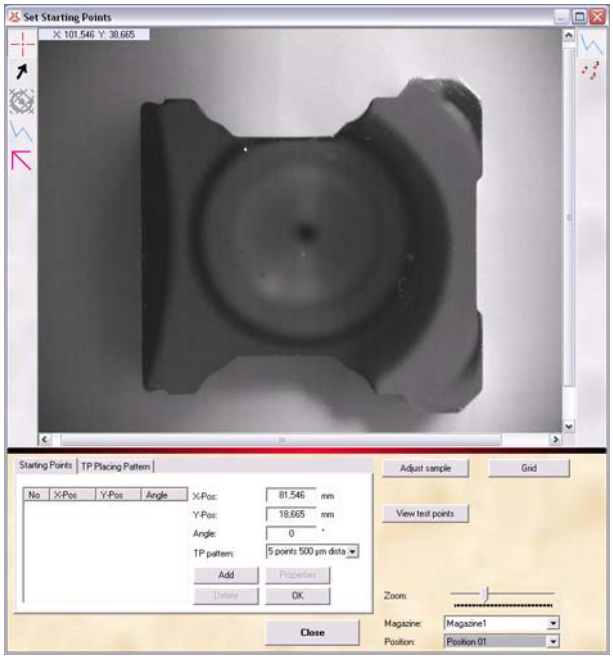
- Select *Settings|Patterns|Placing of Test Point Pattern* to open the *Set Starting Points* window.
- Select a test point pattern (TP-pattern) from the drop down list.
- Select a magazine or sample holder and select a position in the magazine/holder.

The XY-Stage will move the magazine position to the overview camera. A real-time image from the overview camera opens.

- Click **OK** to accept.

A digital image from the overview camera is now opened in the *Set Starting Points* window.



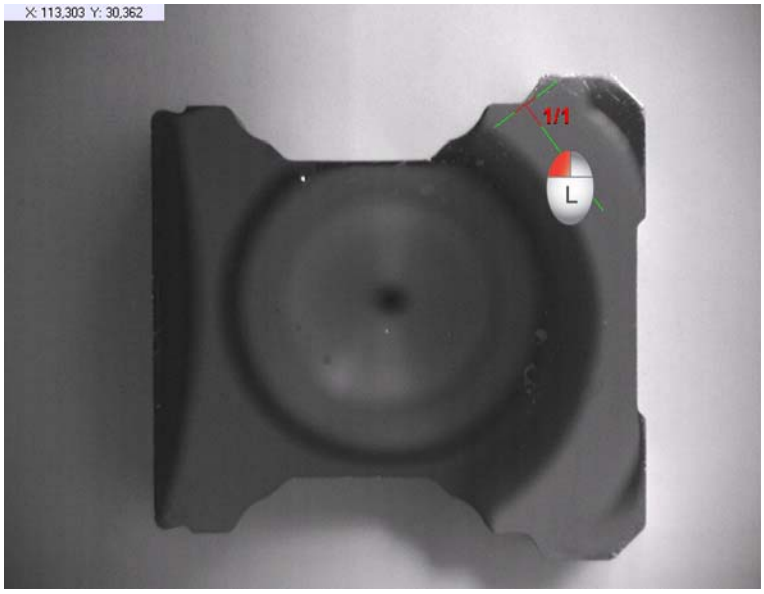


Placing Test Points

■ Select the **Set Starting Point** tool from the toolbar and click in the image to set a starting point for the test point pattern.
Note that the T-line represents the entire test point pattern e.g. numerous test points.

To move a test point pattern:

■ Select the **Move and Turn T-line** tool and click and drag the T-line to move and turn it.

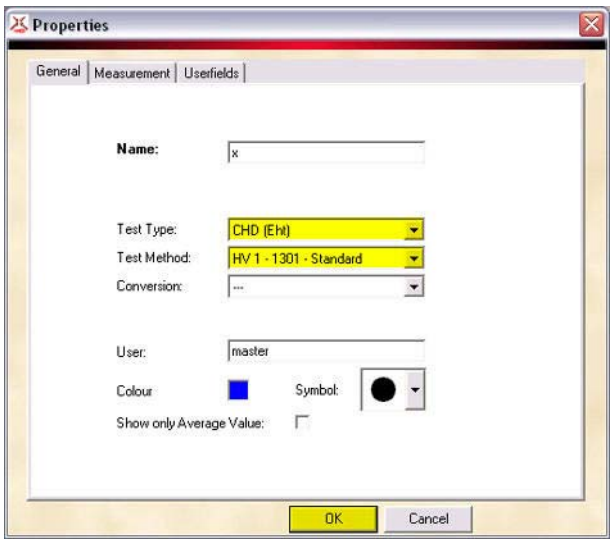


■ In the *Starting Points* tab, select the starting point and click **Properties**.

■ In the opened *Properties* window, select **Test Type** and **Test Method**. This is particularly important if the placing pattern is to include case depth test series.

■ If relevant, select the *Measurement* tab and fill in hardness limit etc. for the case depth test.

■ Click **OK** to close the *Properties* window.

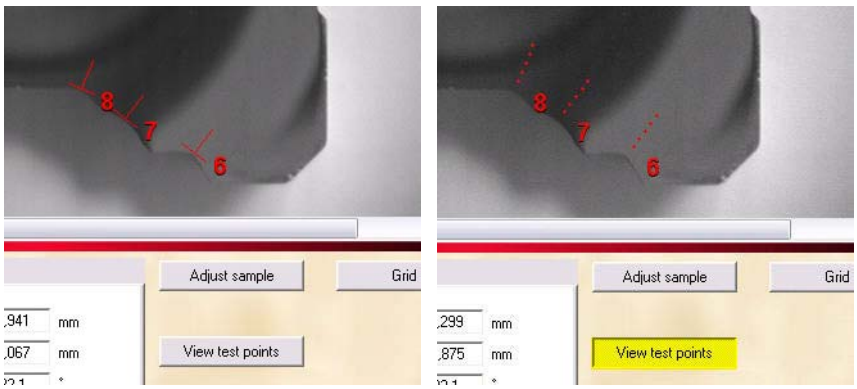


- Repeat to set as many test point patterns as required.
  Please note: different test point patterns can be placed on the sample.

Toggling between T-line and Test Points

To toggle between seeing the T-lines and the individual test points:

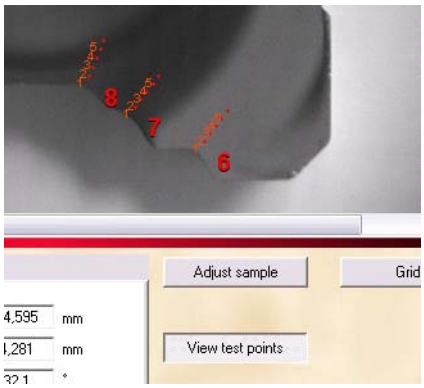
- Click the **View test points** button.



Showing Test Point Numbering

To view the numbering of the individual test points:

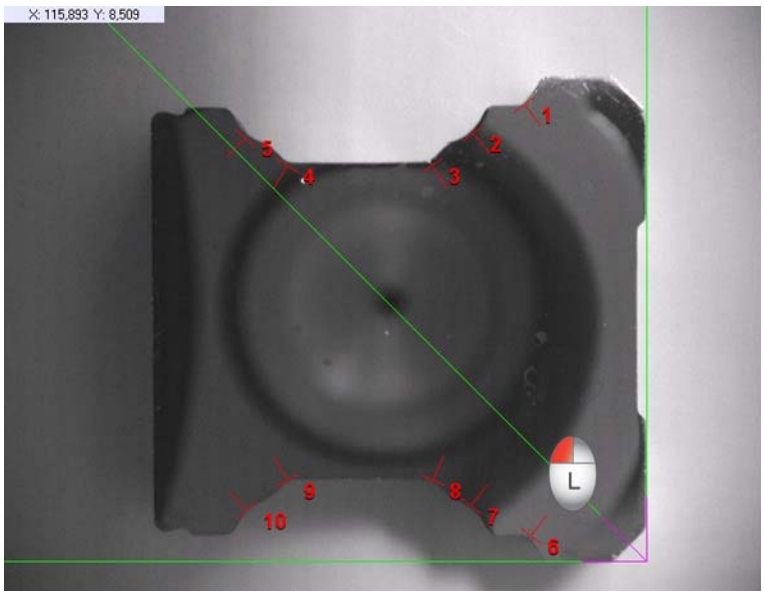
- Click the **Show test point no** tool.



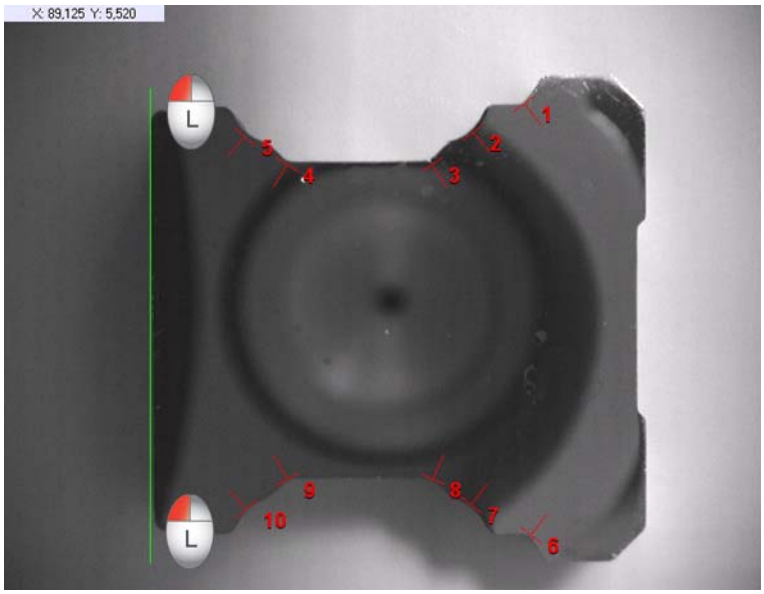
Defining Help Lines

A sample starting point must be added and help lines can be added to facilitate placing of the pattern. These are useful if test points always have to be placed in the same place on the sample.
To set sample starting point and help lines:

■ Select the **Starting Point of Sample** tool and click in the image to place and turn it.
A sample corner or other characteristic part of the sample should be chosen.

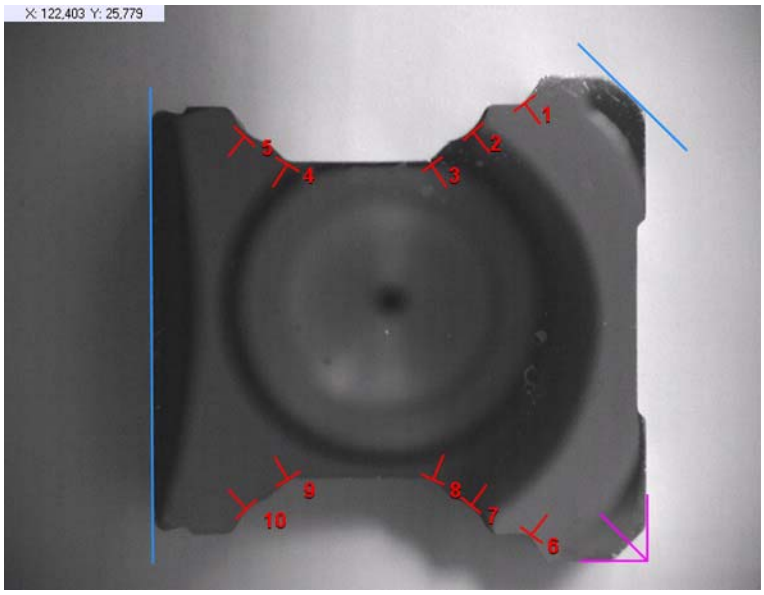


- Select the **Help Lines** tool and left mouse click in the image to set the starting point of the help line and left mouse click in the chart, where the help line is to end.
- Left mouse click in the chart to continue the line, or right mouse click to end the line.



- A *Help line* dialog box opens. Click **OK** to accept. A line offset can be set if relevant.

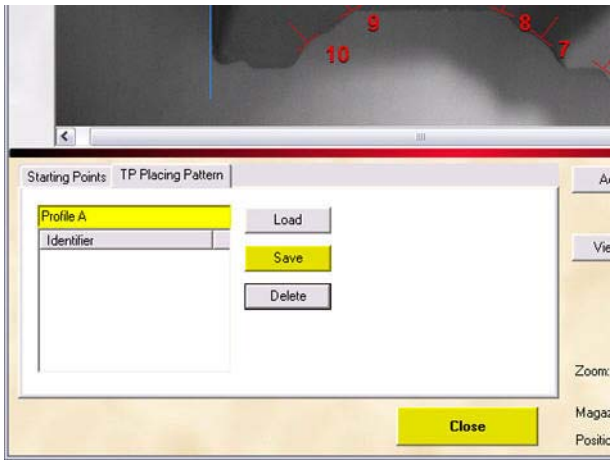
The test point patterns have now been placed and help lines have been created.



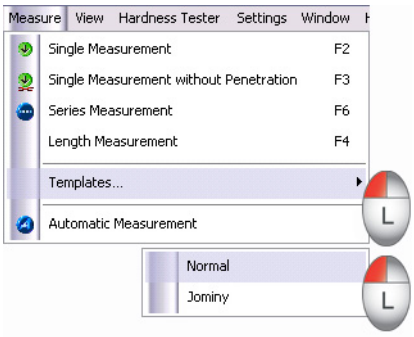
Saving the Test Point Placing Pattern

To save this combination of test point patterns, sample starting point and help lines as a placing pattern:

- Click the *TP Placing Pattern* tab and enter a name for the test point placing pattern.
- Click **Save** and **Close** to save the pattern and close the *Set Starting Points* window.

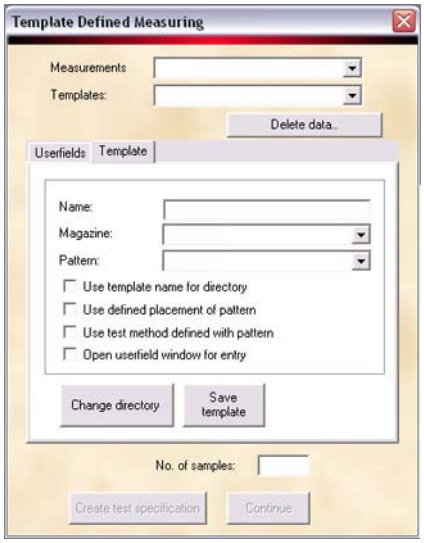


Creating the Template



Having defined magazines, test point patterns and a test point placing pattern, the templates can now be created.

- Select *Measure|Templates|Normal* to open the *Template Defined Measuring* window.
- Select the *Template* tab.

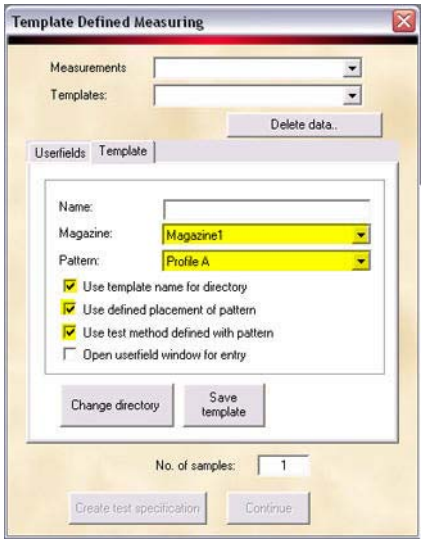


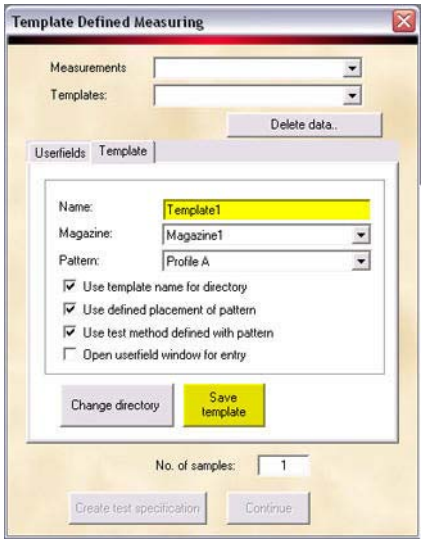
Templates with Placing Pattern

When running a template with a placing pattern, **ecos** uses the overview camera to place the pattern on each sample run. This is particularly useful if the test points should always have the same positions on the sample.

To define a template including a test point placing pattern:

- Select a magazine from the drop down list.
- Tick **Use defined placement of pattern** to use a test point placing pattern.
- Select a placing pattern from the drop down list.
- To automatically use the template name for the naming of the directory, tick **Use template name for directory**.
- Tick **Use test method defined with pattern** to accept the test method selected when the test point pattern was created.
- To force the user to enter userfields for each sample, tick **Open userfield window for entry**.
- Click **Change directory** to change the path for the directory that will be created automatically when running the template.
- To save this combination of magazine and test point placing pattern as a template, enter a name for the template and click **Save template**.



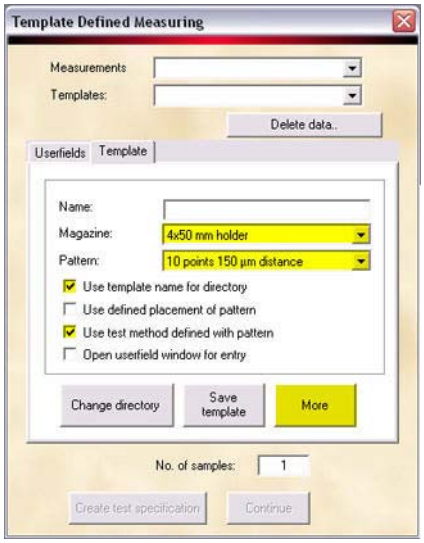


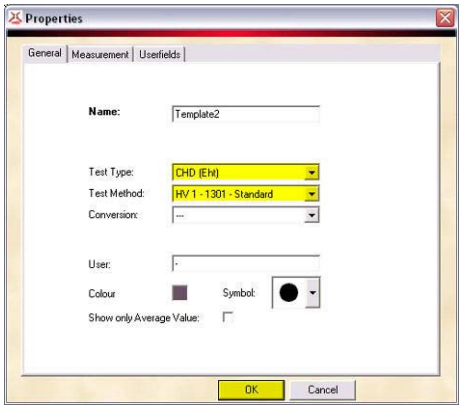
Templates with Test Point Pattern

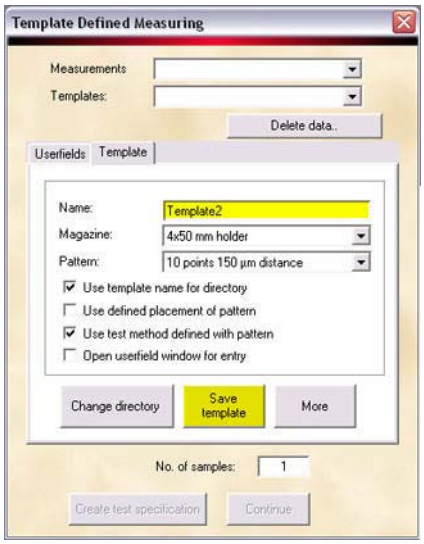
When creating templates with a test point pattern instead of a placing pattern, the overview camera is not in use. The template feature can therefore also be used on Duramin-A300 without an overview camera (version C).

To define a template including a test point pattern:

- Select a magazine from the drop down list.
- Do not tick **Use defined placement of pattern** but select a test point pattern from the drop down list instead.
- To automatically use the template name for the naming of the directory, tick **Use template name for directory**.
- Tick **Use test method defined with pattern** to accept the test method selected when the test point pattern was created.
- To force the user to enter userfields for each sample, tick **Open userfield window for entry**.
- Click **More** to open the *Properties* window for the test point pattern.
- In the opened *Properties* window, select **Test Type** and **Test Method**. This is particularly important if case depth test series are to be performed.
- If relevant, select the *Measurement* tab and fill in hardness limit etc. for the case depth test.
- Click **Change directory** to change the path for the directory that will be created automatically when running the template.
- To save this combination of magazine and test point pattern as a template, enter a name for the template and click **Save template**.



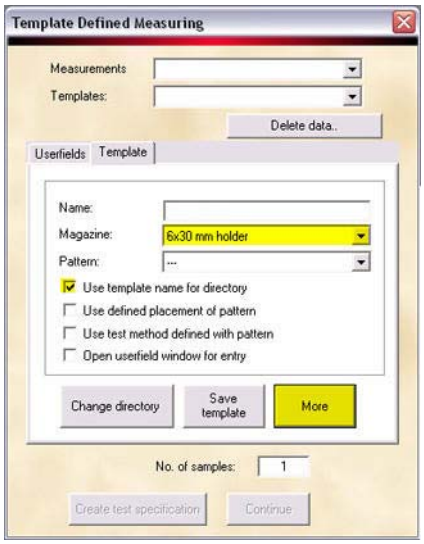




Templates without any Pattern

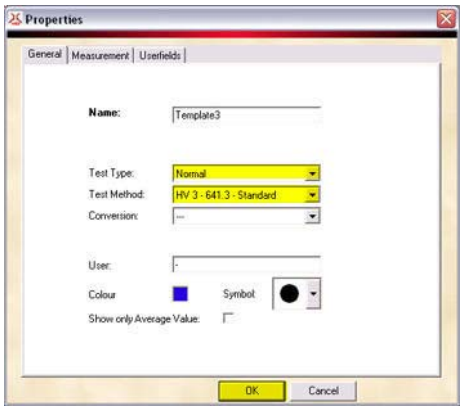
A third possibility, are templates without any pre-defined pattern. This allows visual test points to be selected on each individual sample. This option is particularly useful where samples are similar but not exactly identical e.g. heat affected zones on weldings. When running a template without a pattern, ecos uses the overview camera to place visual test points on each sample run.
To define a template without a pattern:

- Select a magazine from the drop down list.
- Do not tick **Use defined placement of pattern** and do not select any pattern.
- To automatically use the template name for the naming of the directory, tick **Use template name for directory**.

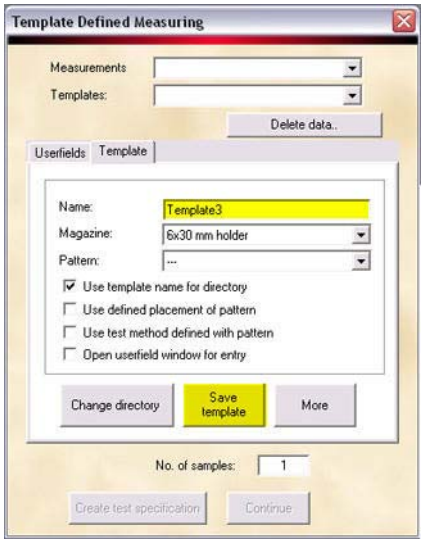


- To force the user to enter userfields for each sample, tick **Open userfield window for entry**.

- Click **More** to open the *Properties* window for the test point pattern.



- In the opened *Properties* window, select **Test type** and **Test method**. This is particularly important if case depth test series are to be performed.
- If relevant, select the *Measuring* tab and fill in hardness limit etc. for the case depth test.
- Click **Change directory** to change the path for the directory that will be created automatically when running the template.
- To save this combination of magazine and visual test points as a template, enter a name for the template and click **Save template**.



Running Templates

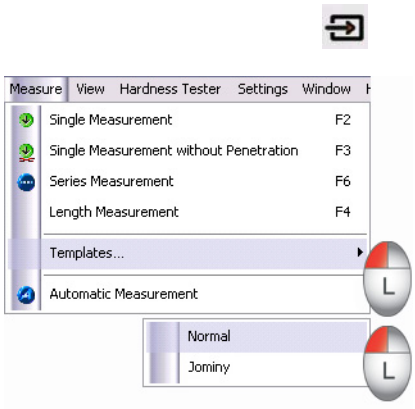
Once the templates have been defined, they can be used for performing measurements.

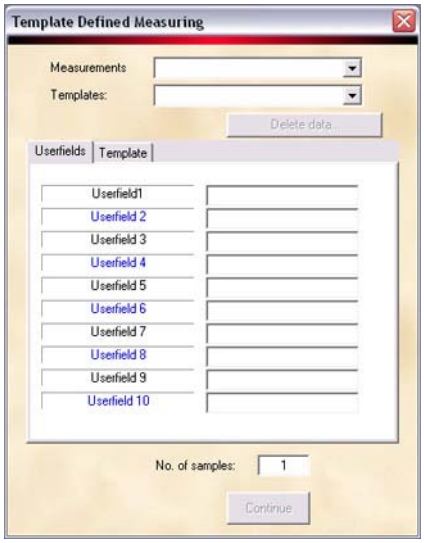
User Level

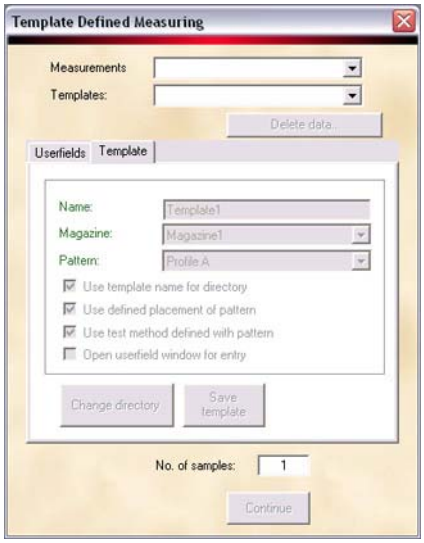
In the following examples, an operator with user level access rights has been logged in. The user is not allowed to define templates but only perform measurements using the templates.

To open the Template Defined Measuring window:

- Click the **Open Template** button on the toolbar or select *Measure*|*Template*|*Normal*.







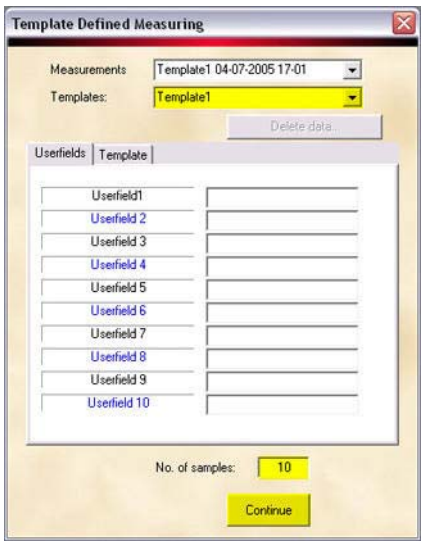
Measuring using a Template with Placing Pattern

When running a template with a placing pattern, **ecos** uses the overview camera to place the pattern on each sample prior to measuring.

Selecting a Template

To start measuring using a template:

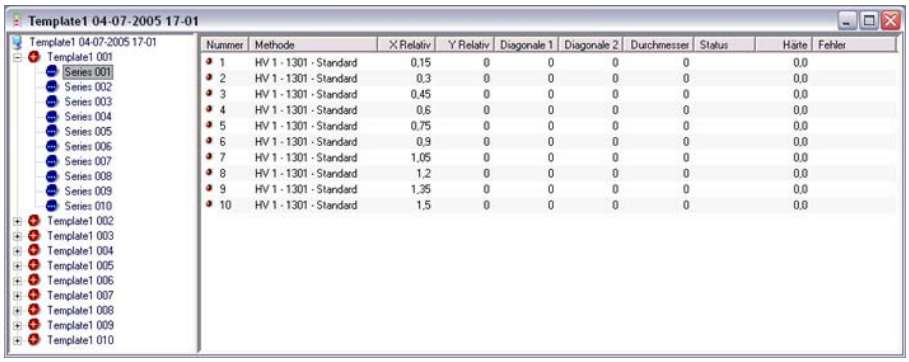
- Select a template from the drop down list.
- Enter the number of samples to be tested.
- Click **Continue.**



HINT
The amount of samples to be tested is not restricted by the number of sample positions in the magazine, as **ecos** will automatically prompt for the magazine to be refilled until all samples have been tested.

Directory

The directory is automatically created and opened.


Template1 04-07-2005 17-01
Template1 04-07-2005 17-01
Template1 001
Series 001
Series 002
Series 003
Series 004
Series 005
Series 006
Series 007
Series 008
Series 009
Series 010
Template1 002
Template1 003
Template1 004
Template1 005
Template1 006
Template1 007
Template1 008
Template1 009
Template1 010
Nummer
Methode
X Relativ
Y Relativ
Diagonale 1
Diagonale 2
Durchmesser
Status
Härte
Fehler
1 HV 1 - 1301 - Standard 0,15 0 0 0 0 0,0
2 HV 1 - 1301 - Standard 0,3 0 0 0 0 0,0
3 HV 1 - 1301 - Standard 0,45 0 0 0 0 0,0
4 HV 1 - 1301 - Standard 0,6 0 0 0 0 0,0
5 HV 1 - 1301 - Standard 0,75 0 0 0 0 0,0
6 HV 1 - 1301 - Standard 0,9 0 0 0 0 0,0
7 HV 1 - 1301 - Standard 1,05 0 0 0 0 0,0
8 HV 1 - 1301 - Standard 1,2 0 0 0 0 0,0
9 HV 1 - 1301 - Standard 1,35 0 0 0 0 0,0
10 HV 1 - 1301 - Standard 1,5 0 0 0 0 0,0

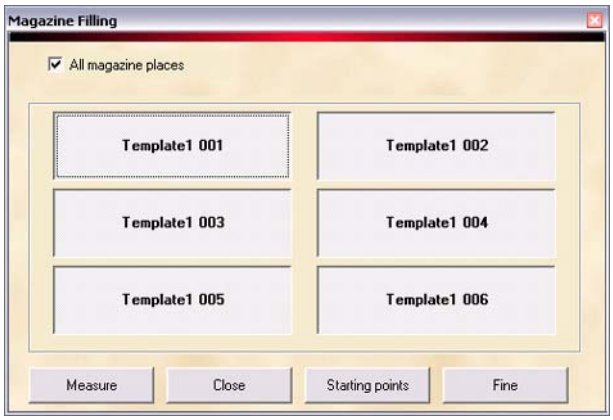
In the example shown, the template name *Template1* has been used for the directory name with the date and time added.
The directory contains:

- Ten samples as specified.
- Each sample has 10 test series as specified in the test point placing pattern used.
- Each series contains ten test points as specified in the test point pattern used.

- The test points are set up for HV1 test method using an objective lens with 1301x total magnification as specified in the test point pattern.

Magazine Filling Window

A *Magazine Filling* window will open showing all positions in the magazine selected with the template.



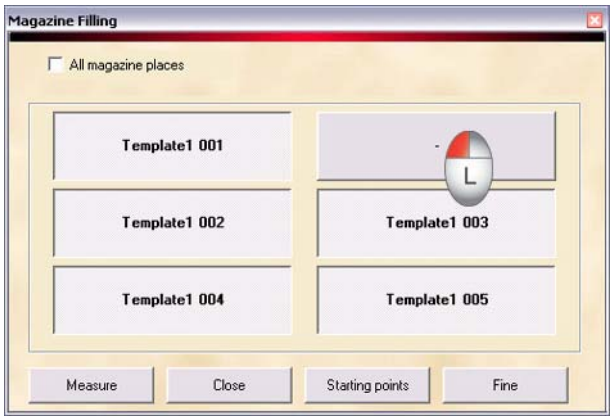
If the number of samples entered is equal to or higher than the number of magazine positions, all positions will be filled with samples. When performing the measurements a dialog box will automatically prompt for the magazine to be refilled until all samples have been tested.

If the number of samples entered is lower than the number of magazine positions, ecos will simply suggest filling up the magazine from position 1.

Selecting Magazine Positions

With fewer samples than positions, the positions that are to be used can be selected.

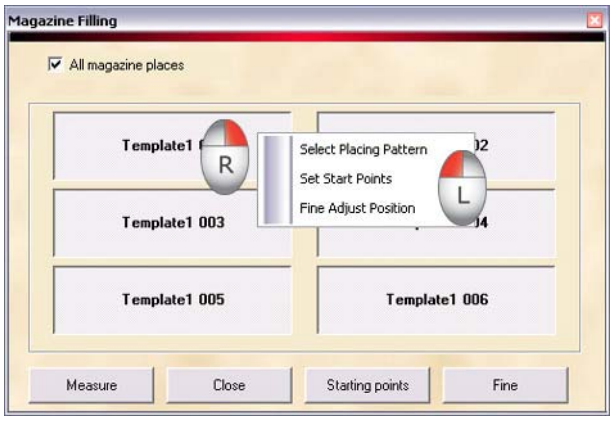
- Deselect **All magazine positions**.
- To select or deselect magazine positions, simply mouse click in the *Magazine Filling* window.



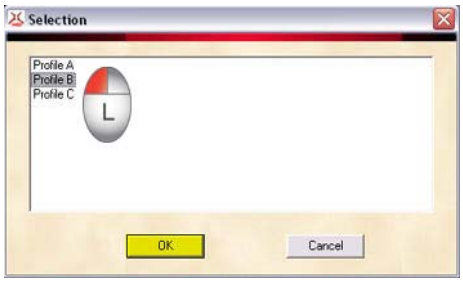
Individual Sample Options

A context menu can be opened for each individual sample in the magazine:

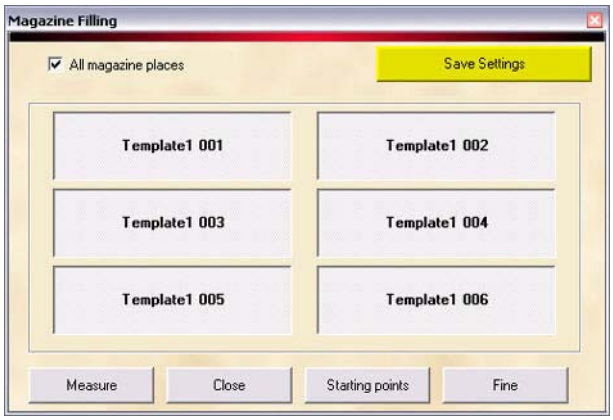
- Right click on a sample position in the *Magazine Filling* window.
- Select *Select Placing Pattern* to open the placing pattern *Selection* window.



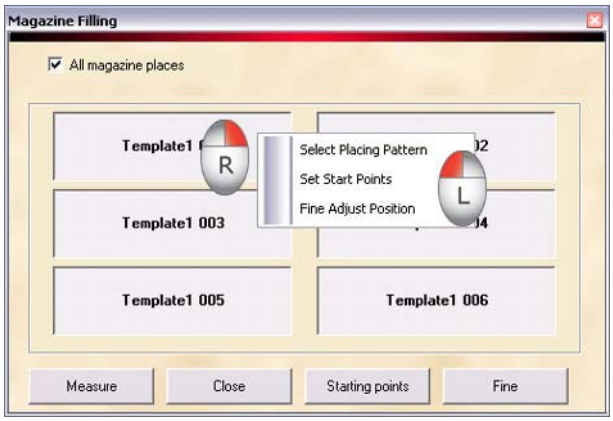
If relevant, select a different placing pattern as specified in the template. This option allows different placing patterns to be run on the samples in the magazine.



- To save this placing pattern setting click **Save Settings**.



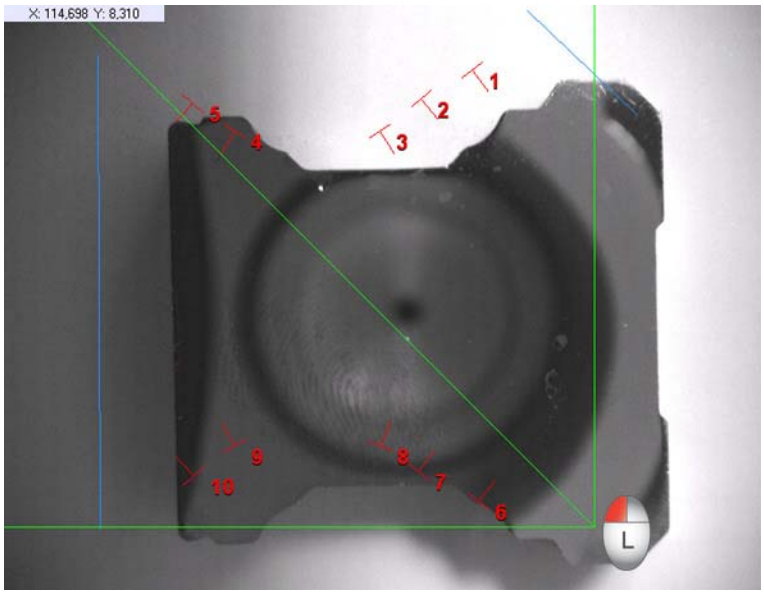
- Select *Set Start Points* to place the test point placing pattern on this sample only.
- Select *Fine Adjust Position* to fine position the test point patterns on this sample only.



Placing Patterns with Help Lines

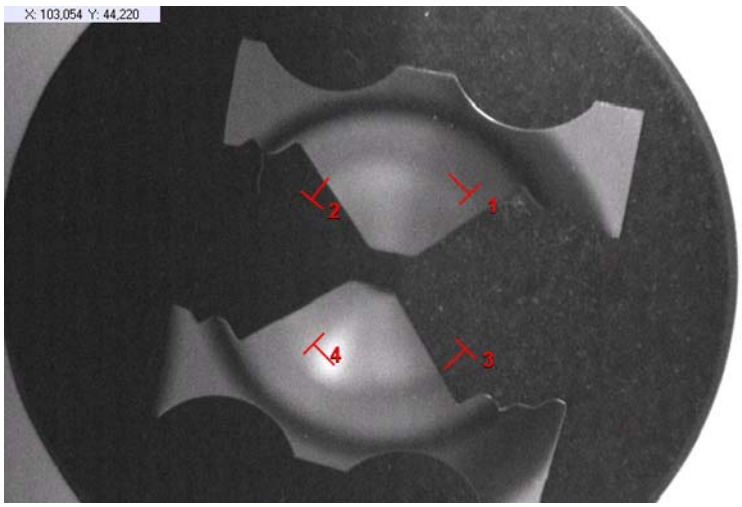
To place the test point placing pattern on all samples in the magazine:

- In the *Magazine Filling* window, Click **Starting points** and the XY-stage moves the magazine position 1 to the overview camera.
  A real-time image of the overview camera opens.
- Click **OK** to accept.
  A digitalised image from the overview camera opens and the test point placing pattern including help lines is placed in the image.
- Click on the test point placing pattern and drag the pattern in place.
- Click **Apply** to accept and move to the next sample position.
- Repeat until the pattern has been placed on all samples in the magazine.



Placing a Pattern without Help Lines

In the example above, help lines were used to facilitate the placing of the pattern. In some cases, help lines are not useful e.g. if the relation between the sample edge and the placing of the test point pattern varies.

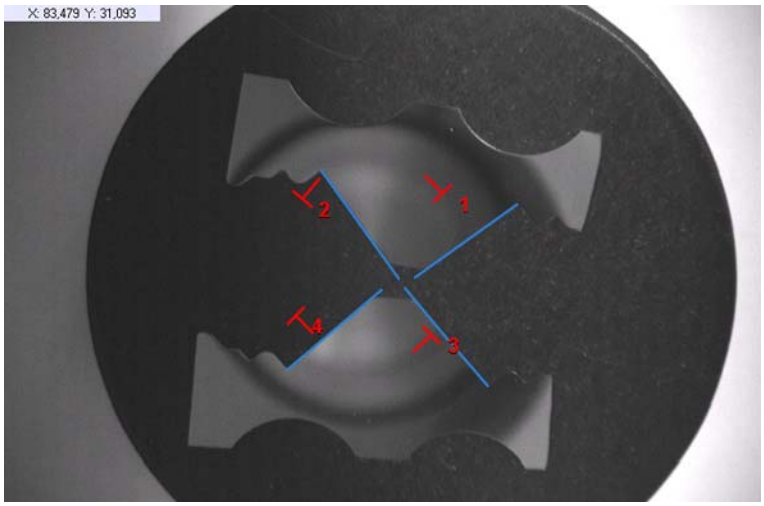


In this example, a pattern without help lines has been used.

Adding Help Lines

Help lines can be added now if relevant:

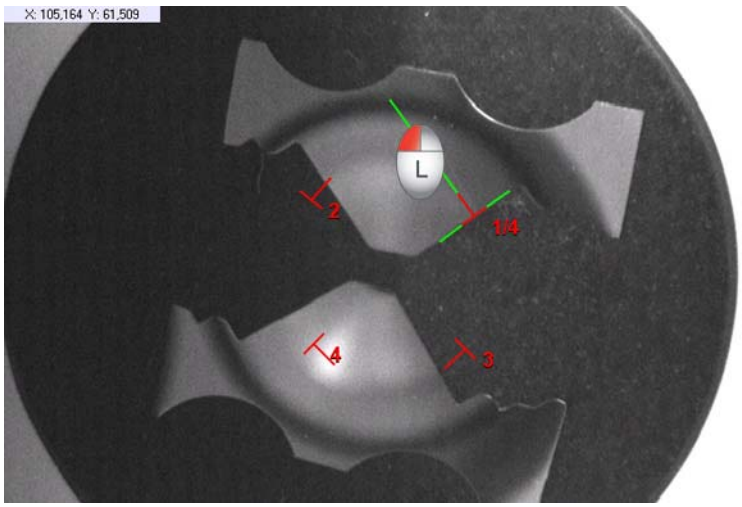
- Select the **Help Line** tool and click to draw help lines as previously described.



Moving Test Point Patterns

Move each test point pattern in place:

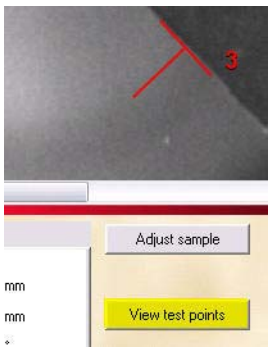
■ Select the **Move and Turn T-line** tool and click and drag each individual test point pattern into place and turn the T-line to adjust the angle.

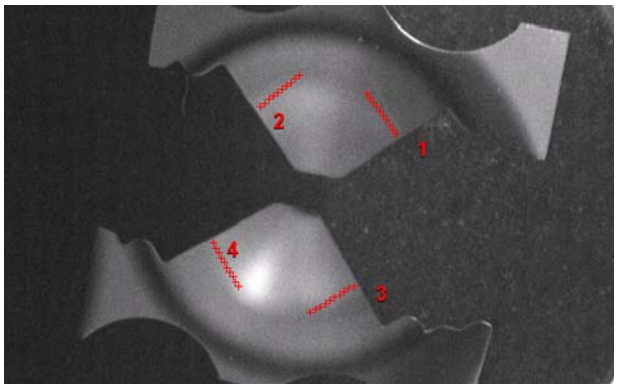


Viewing Test Points

The T-lines represent test points patterns e.g. numerous test points. To view the individual test points:

■ Click the **View test points** button.

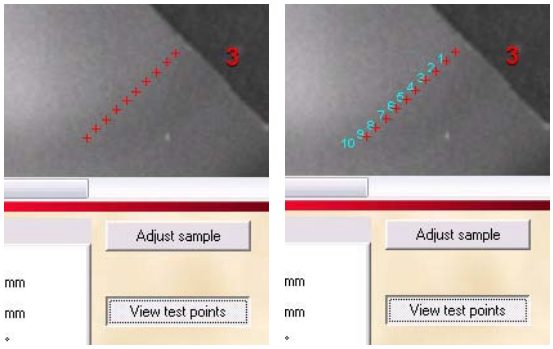




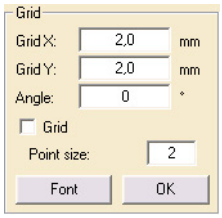
Viewing Test Point Numbering

To view the numbering of the individual test points:

■ Click the **Show test point no.** tool.



Editing Font and Point Size



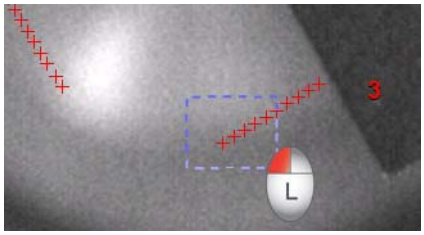
The font, font style, colour and size and the point size can be edited:

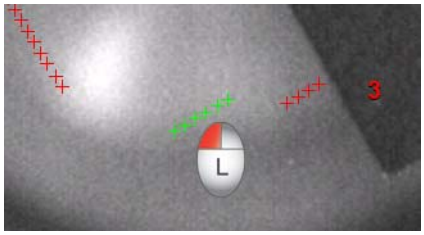
- Click the **Grid** button to open the settings.
- Enter a test point size.
- Click **Font** and select *Series* to edit the font for the test point pattern or *Indents* to edit the font for the individual test points.

Moving Individual Test Points

Individual test points within the test point pattern can be moved:

- Select the **Select and Move** tool.
- Mouse click and drag to select the test points to be moved.
- Click and drag to move them.





Deleting Individual Test Points

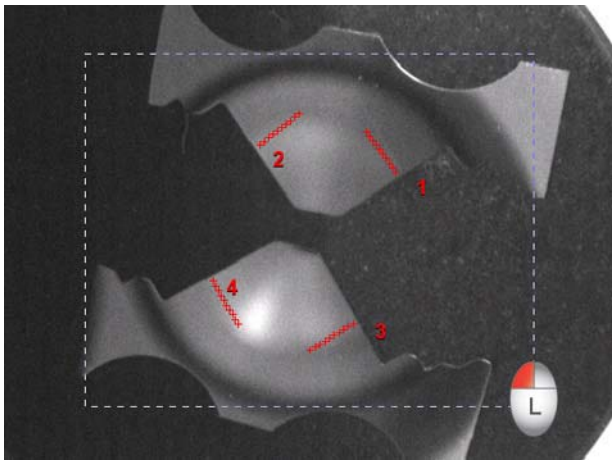
To delete individual test points:

- Select the **Select and Move** tool.
- Mouse click and drag to select the test points to be deleted.
- Press <Delete>.

Saving the Overview Image

The overview image of the sample, including test points or test point pattern, help lines etc. can be saved and included in a report.
To save an image:

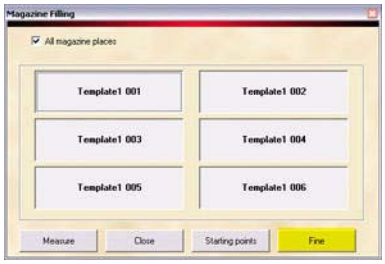
- Select the **Select and save region** tool.
- Mouse click and drag to select the part of the image to be saved.
- Release the mouse to save the selected region.

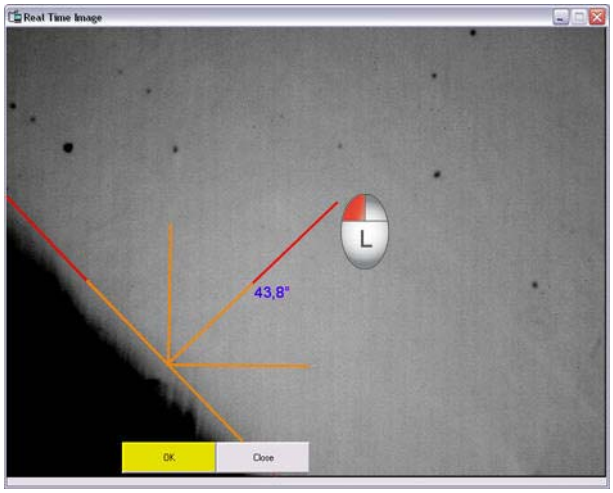


Fine Positioning of Test Point Patterns

To fine adjust the position and angle of each test point pattern on each samples in the magazine:

- Click **Fine** and the XY-Stage will move the samples to the objective lens for fine positioning.
- Click **OK** to accept each fine positioning.





Start Measuring

To start measuring all test points on all samples in the magazine:
■ Click **Measure** to start measuring.

Re-filling the Magazine

When **ecos** has been set up to measure more samples than positions in the magazine, a dialog box will automatically prompt for the magazine to be refilled until all samples have been tested

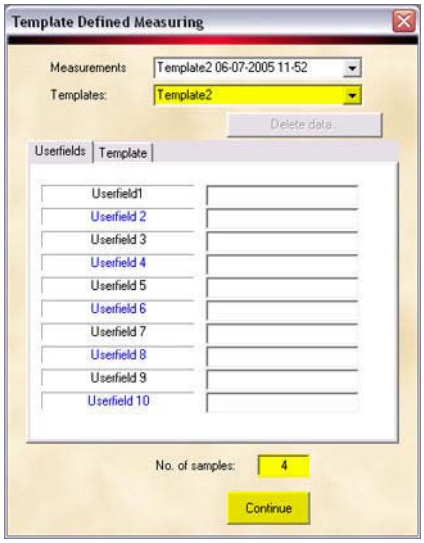
Measuring using a Template with Test Point Pattern

When running a template with a test point pattern, the overview camera is not in use. Therefore Duramin-A300 without an overview camera (version C) can also utilise this feature.
The magazine positions need to be defined to move to the positions where the test point pattern should be placed.

Selecting a Template

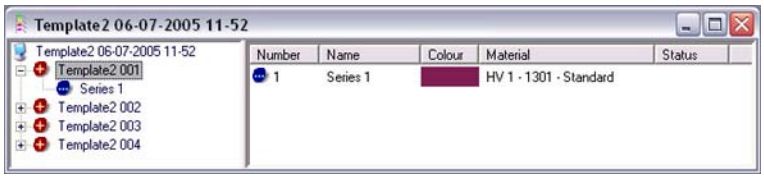
To start measuring using a template:

- Select a template from the drop down list.
- Enter the number of samples to be tested.
- Click **Continue**.



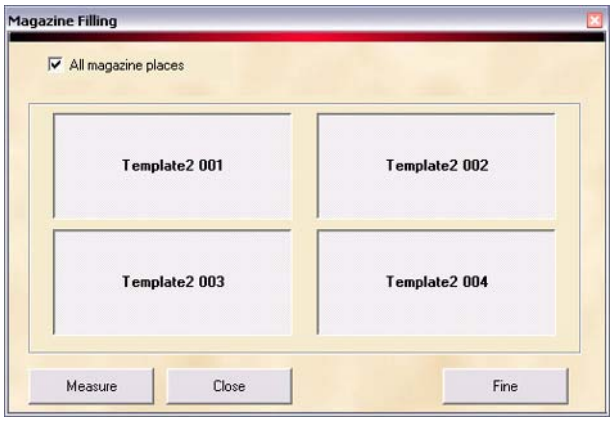
Directory

The directory is automatically created and opened.



Magazine Filling Window

A *Magazine Filling* window will open showing all occupied samples in the magazine.
To change the selection of positions, please follow the procedure previously described in *Defining Sample Positions*.



Setting Individual Sample Options

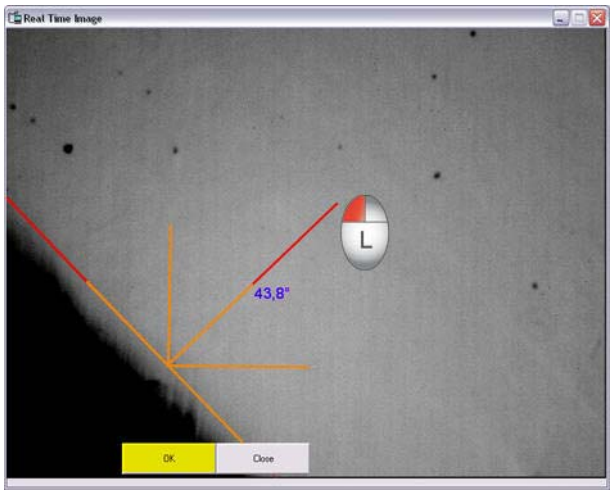
A context menu can be opened for each individual sample in the magazine:

- Right click on a sample position to open the context menu.
- Select *Fine Adjust Position* to fine adjust the position and angle for this sample only.

Fine Positioning of Test Point Patterns

To fine adjust the position and angle of the test point pattern on each sample in the magazine:

- Click **Fine** and the XY-Stage will move the samples to the objective lens for fine positioning.
- Click **OK** to accept the fine positioning.



Start Measuring

To start measuring all test points on all samples in the magazine:

- Click **Measure** to start measuring.

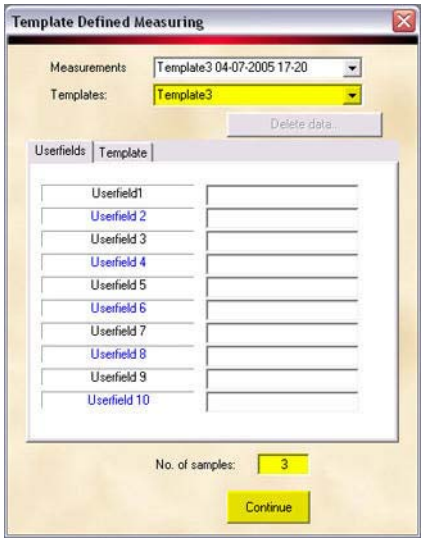
Measuring using a Template and Visual Test Points

When running a template without any pre-defined pattern, ecos uses the overview camera to set test points on each sample prior to measuring.

Selecting a Template

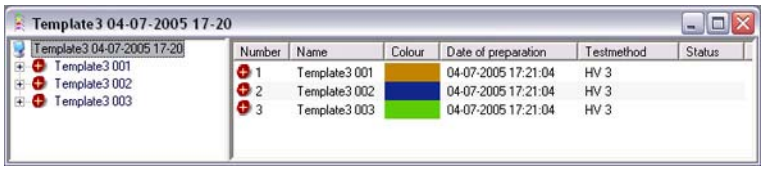
To start measuring using a template:

- Select a template from the drop down list.
- Enter the number of samples to be tested.
- Click **Continue**.



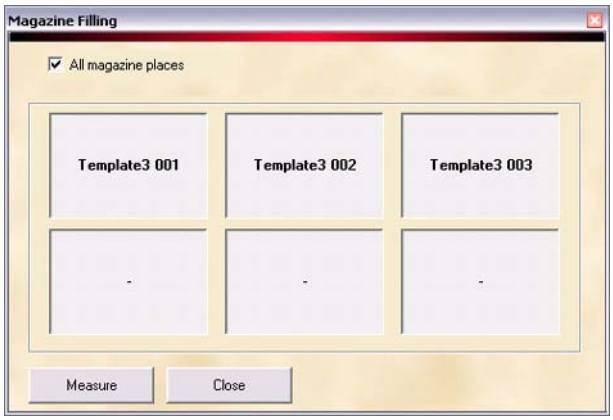
Directory

The directory is automatically created and opened. The requested number of samples has been created. Each sample contains one test series but no test points as they have not been defined yet.



Magazine Filling Window

A *Magazine Filling* window opens showing all occupied samples in the magazine.

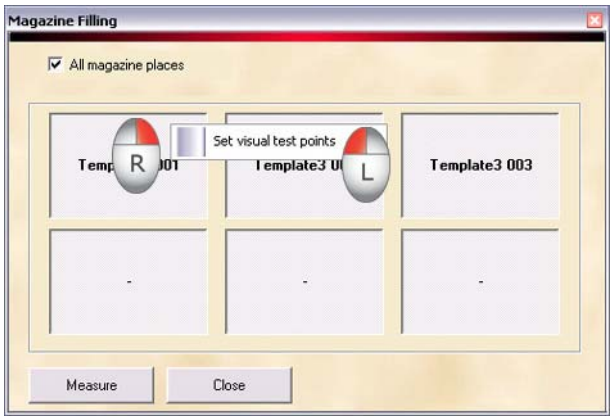


To change the selection of positions, please follow the procedure previously described *Defining Sample Positions*.

Setting Individual Sample Options

A context menu can be opened for each individual sample in the magazine:

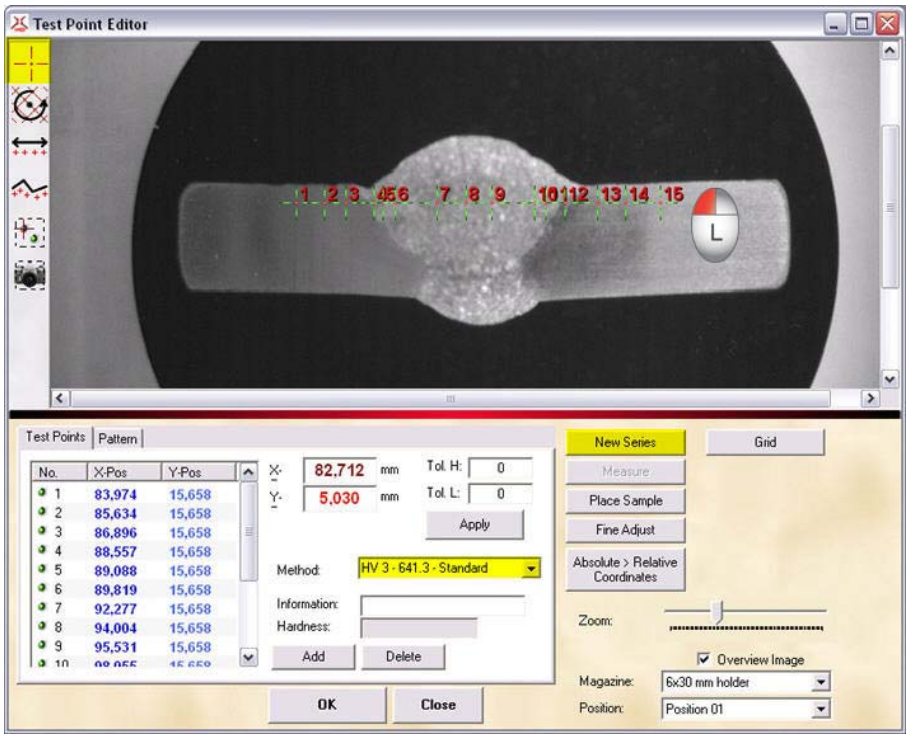
- Right click on a sample position to open the context menu.
- Select *Set visual test points.*
- The XY-stage moves the magazine position to the overview camera.
- A real-time image of the overview camera opens. Click **OK** to accept.
- A digital image opens in the *Test Point Editor* window.



Setting Visual Test Points

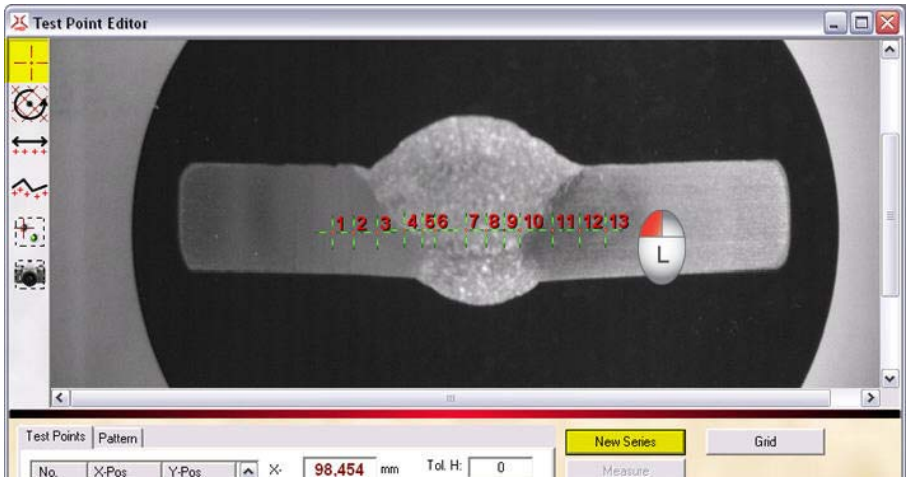
In the *Test Point Editor* window:

- Make sure that the correct method is selected.
- Select the **Set Test Point** tool and mouse click to set test points.



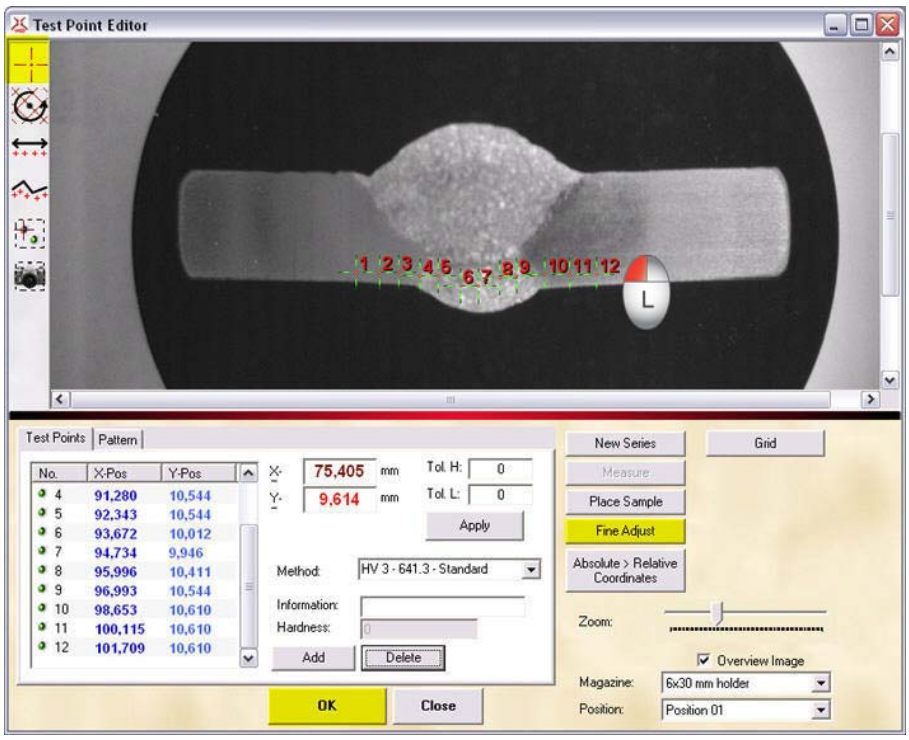
Please note, all the tools usually available in the *Test Point Editor* can be used, including saving the overview image with the test points visible.

- To create multiple series click the **New Series** button.
- Repeat, creating as many series and test points as required.



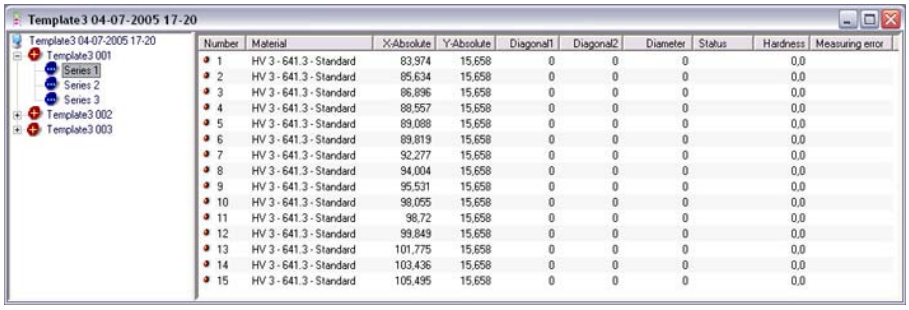
When all test points and series have been created:

■ Click **Fine Adjust** to fine adjust the position of each test point under the objective lens or click **OK** to accept the test points and close the *Test Point Editor*.



Automatic Creation of Series

When multiple series are created, the *Test Specification* window is automatically updated to include all series and test points.



Start Measuring

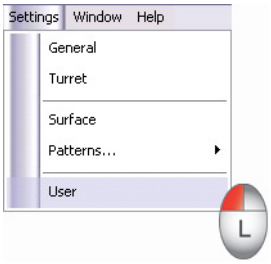
To start measuring all test points on all samples in the magazine:

■ Click **Measure** to start measuring.

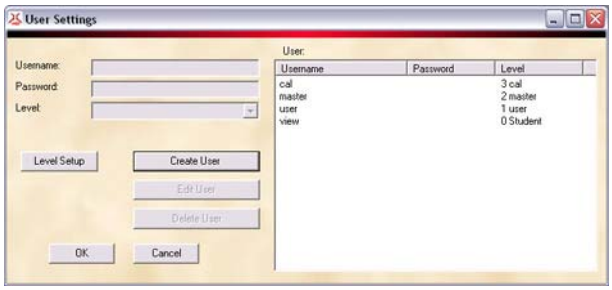
10. Managing User Levels

Managing User Rights

The software includes an administration tool for management of users and their access rights. Three user levels are available in order to ensure data security and that internal hardness testing procedures are followed.
The user level rights can be altered to match requirements. User level settings can only be changed when a *master* user is logged on.



To open the user administration tool:
■ Select *Settings*|*User*



User Level 0 - Viewer

User level 0 is a view-only access level. The operator can open saved measurements and print result reports. The operator cannot set-up test series, change any measurements or perform any new measurements.

User Level 1 - User

In addition to the above mentioned functions, operators with user level 1 access rights can perform measurements according to preset parameters.

User Level 2 - Master

Operators with user level 2 access rights can perform all functions described in this Instruction Manual. User level 2 access rights should only be granted to trained operators.

User Level 3 - Calibration

In addition to the 3 user levels, a calibration level is available. Calibration access rights should only be granted to trained service and calibration technicians.

User Level Access Overview

The following table shows which functions the different user levels give access to.

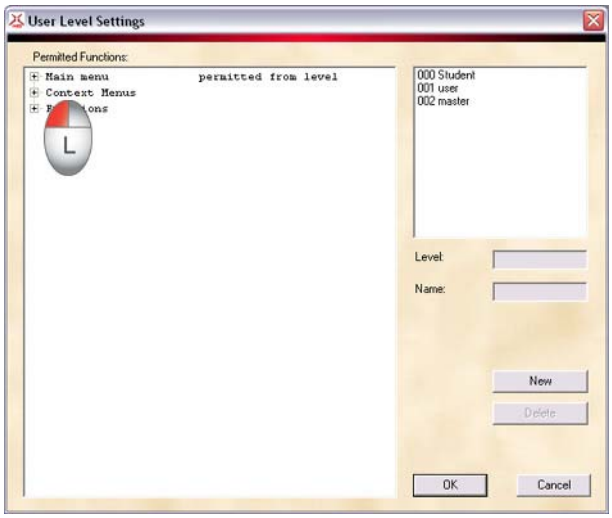
Default Access Rights		**User level**		
Chapter	**Task**	**0**	**1**	**2**
2	Swivel lens in/out	-	X	X
	Focus	-	X	X
	Move the XY-stage	-	X	X
3	Open a directory, folder, sample, series	X	X	X
	Create a directory	-	X	X
	Create/edit a folder	-	X	X
	Delete a folder	-	-	X
	Create/edit a sample	-	X	X
	Delete a sample	-	-	X
	Create/edit a test series	-	X	X
	Delete a test series	-	-	X
4	Single measurement	-	X	X
	Single measurement wo. penetration	-	X	X
	Re-measure an indentation	-	X	X
	Replace an indentation	-	X	X
	Delete a measurement	-	X	X
5	Create a test point pattern	-	X	X
	Save a test point pattern	-	-	X
	Delete a test point pattern	-	-	X
	Series measurement	-	X	X
	Open active series window	X	X	X
6	Case depth measurement	-	X	X
	Open statistics window	X	X	X
7	Open automatic measuring window	-	X	X
	Perform automatic measuring	-	X	X
8	Create holder/magazine positions	-	-	X
	Perform automatic measuring	-	X	X
9	Create test point patterns	-	-	X
	Create test point placing pattern	-	-	X
	Create templates	-	-	X
	Measure using templates	-	X	X
10	Create/edit/delete a user	-	-	X
	Define level access rights	-	-	X
	Create new levels	-	-	X
11	View statistics in active series window	X	X	X
	View statistics in Statistics window	X	X	X
12	Print a report	X	X	X
	Print a statistics report	X	X	X
	Edit a report template	-	-	X
13	Archive entire directory	-	-	X
	Archive folders, samples, series	X	X	X

Default Access Rights		**User level**		
Chapter	**Task**	**0**	**1**	**2**
	Export entire directory	-	-	X
	Save export templates	-	-	X
	Export folders, samples, series	X	X	X
	Export to Excel	X	X	X
	Restore archived data	-	-	X
	Import data from databases	-	-	X
14	Set general settings	-	-	X
	Set image analysis settings	-	-	X
	Create/edit/delete userfields	-	-	X
	Set file locations	-	-	X
15	Create methods and surface settings	-	-	X
16	Calibrate	-	-	-
17	View software version	X	X	X
	View software code	X	X	X
	Enter upgrade code	-	-	X

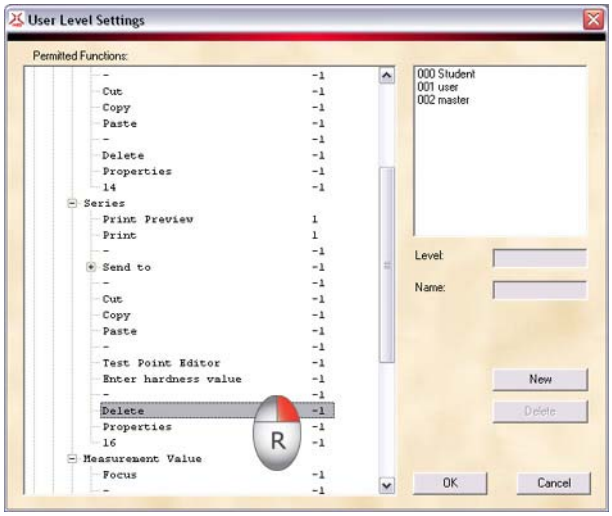
Adjusting Level Setup

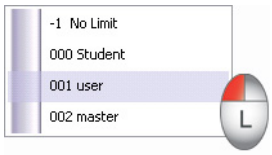
The default level setup can be altered to suit specific needs.
To edit the level setup:

- Click **Level Setup** to view the access rights for the functions and commands.
- Click in the tree structure to expand the structure.

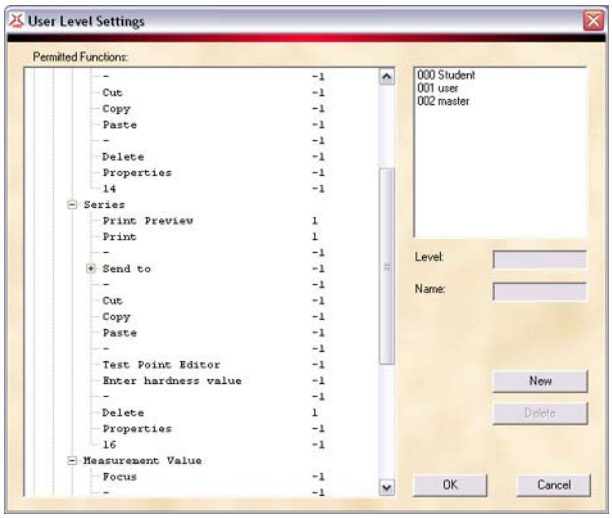


- Select the function or command for which access rights is to be changed.
- Right mouse click to open the context menu.





- Select the user level to be applied to this function or command: Level -1 is a no limit setting.
- Click **OK** to accept and close the *User Level Settings* window.



Creating a New User

To create a new user:

- Click **Create User** in the *User Settings* window.

- Enter a username, a password and select a user level from the drop down list.
- Click **OK** to add the user.
- Click **OK** to close the *User Settings* window.

Editing a User

To edit a user:

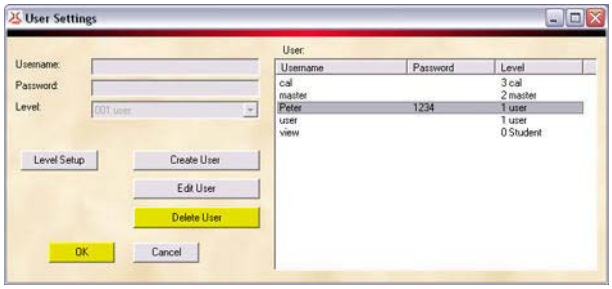
- Select a user and click **Edit User**.

- Edit the name, password or user level and click **OK** to accept.
- Click **OK** to close the *User Settings* window.

Deleting a User

To delete a user:

- Select a user and click **Delete User**.
- Click **OK** to close the *User Settings* window.



Login

ecos does not need to be shut down in order to login as a different user. To login:

- Select *File|Login*.
- Enter the username and password and click **OK**.

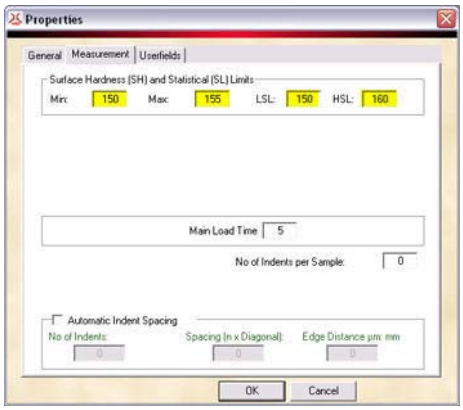
11. Statistics

The **ecos** software enables statistical information and evaluations to be carried out on the measurements performed.

Setting Limits

In order to allow ecos to perform statistical evaluations, limits have to be set in the *Properties* window of the test series or sample:

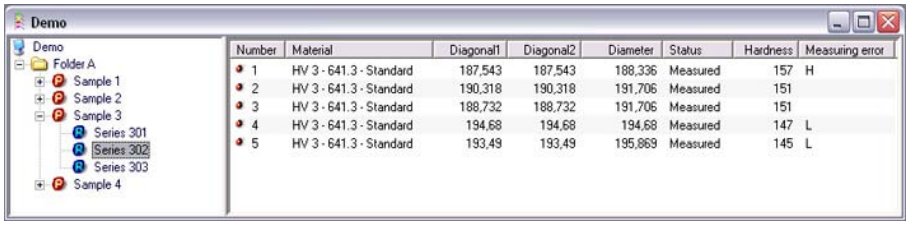
- Select a test series or a sample.
- Right mouse click and select *Properties*.
- Select the *Measurement* tab.
- Enter surface hardness limits and statistical limits.



Two kinds of limits can be set, and it is important to understand the difference.

Surface Hardness Limits

Surface hardness limits Min and Max are set to determine whether hardness values are within a certain hardness range.
Measurements outside the set surface hardness limits will be marked with L (too low) or H (too high) in the *Test Specification* window.



Statistical Limits

Statistical limits LSL (low statistical limit) and HSL (high statistical limit) are set to determine whether or not a measurement is included in the statistical evaluation.

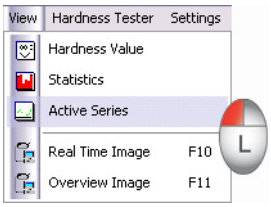
Reading the Statistical Results

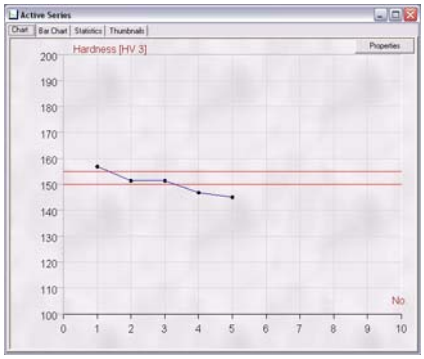
Two windows offer statistical information:

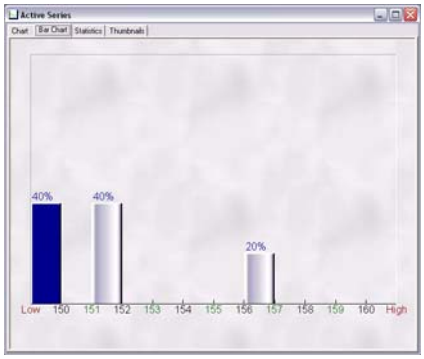
Active Series Window

In the *Active Series* window information for a specific test series can be viewed.
To open the *Active Series* window:

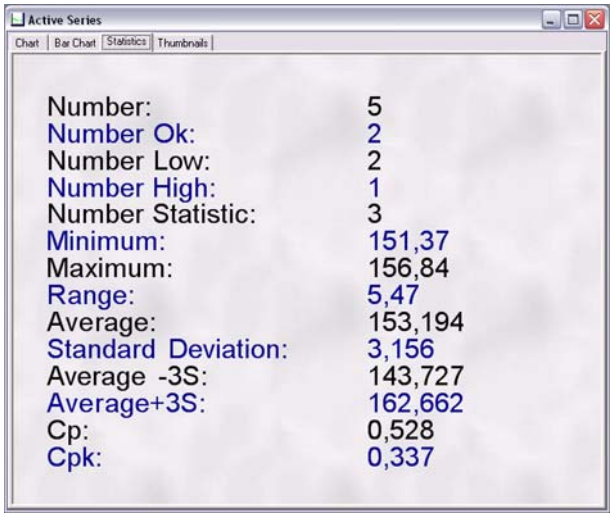
- Select a series.
- Select *View|Active Series*.







The *Chart* window illustrates the hardness of the individual measurements; red lines indicate the surface hardness limits.
The *Bar Chart* window shows the distribution of the measurements.



The *Statistics* window displays the statistical evaluation.

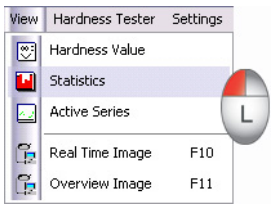
Number:	the total number of measurements
Number OK:	the number of measurements within the surface hardness limits
Number Low:	the number of measurements below the Min surface hardness limit
Number High:	the number of measurements above the Max surface hardness limit
Number Statistic:	the number of measurements within the statistical limits

The following evaluations **only** apply to the measurements **within** the statistical limits:

Minimum:	the lowest value within the statistical limits
Maximum:	the highest value within the statistical limits
Range:	Maximum – Minimum
Average:	the arithmetical average
Standard deviation:	standard deviation
Average –3S:	the Average - 3 x standard deviation
Average +3S:	the Average + 3 x standard deviation
Cp:	the process conducting capacity
Cpk:	the process conducting index

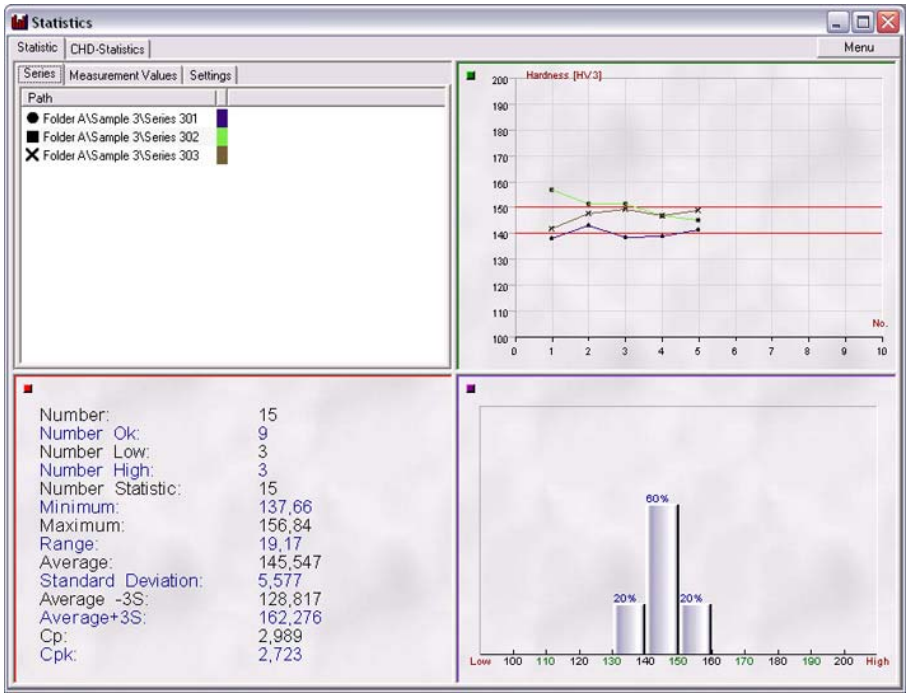
Statistics Window

The *Statistics* window shows statistical information for several test series and a graphical comparison of these test series.

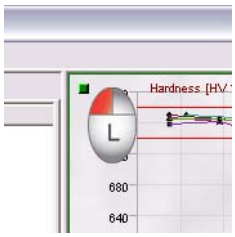


To open the *Statistics* window:

- Select *View*|*Statistics*.
- Drag a sample or individual test series into the *Statistics* window.



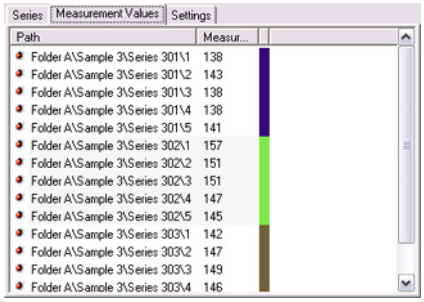
The *Chart*, *Statistics* and *Bar Chart* windows are similar to those shown in the *Active Series* window; only these include all series and measurements.



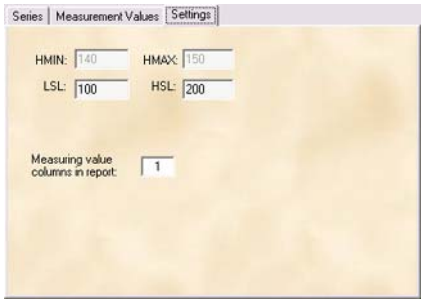
To enlarge one of the windows:

- Click the box in the upper left corner.
- Click again to close the window.

- Click the *Measurement Values* tab to show the individual hardness measurements.


Series
Measurement Values
Settings
Path
Measur...
Folder A\Sample 3\Series 301\1 138
Folder A\Sample 3\Series 301\2 143
Folder A\Sample 3\Series 301\3 138
Folder A\Sample 3\Series 301\4 138
Folder A\Sample 3\Series 301\5 141
Folder A\Sample 3\Series 302\1 157
Folder A\Sample 3\Series 302\2 151
Folder A\Sample 3\Series 302\3 151
Folder A\Sample 3\Series 302\4 147
Folder A\Sample 3\Series 302\5 145
Folder A\Sample 3\Series 303\1 142
Folder A\Sample 3\Series 303\2 147
Folder A\Sample 3\Series 303\3 149
Folder A\Sample 3\Series 303\4 146

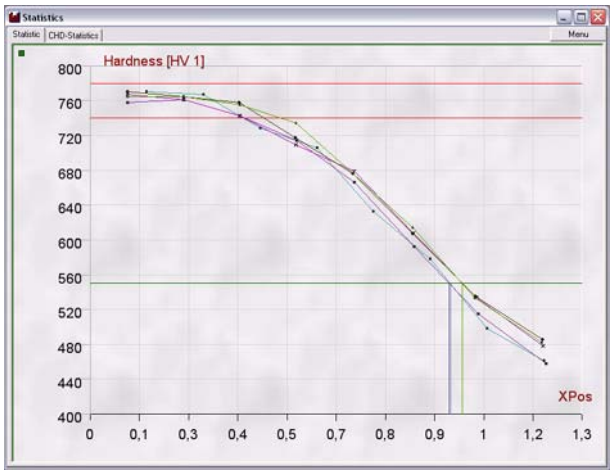
- Click the *Settings* tab to show the hardness limits for the first series. The statistical limits are shown and can re edited.



The number of columns in a report can be set, please note that the report might have to be changed to match your setting.
If the report template *Statistics* is printed the number of columns must be set to **1**. If the report template *Statistics with Image* is printed the number of columns must be set to **5**.

CHD Statistics

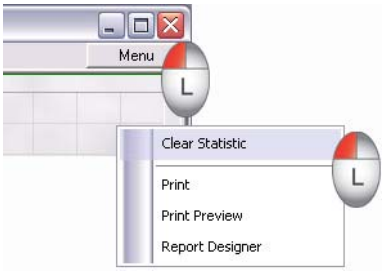
The *Statistics* window can be used for any test series including case depth test series, allowing comparison of CDH measurements and CHD values.



NOTE
For more information on *Case Depth Measurements* please return to chapter 6.

Clearing the Statistics

To clear the statistics:



- Click the **Menu** button in the upper right corner and select *Clear Statistic*.

Statistical Formulas

The following formulas used:

Process Conducting Capacity

Cp = (USL – LSL) / (6 x standard deviation)

Process Conducting Index

Cpk is calculated as the lower value of the following two:
Cpk = (average – LSL) / (3 x standard deviation) or
Cpk = (USL - average) / (3 x standard deviation)

12. Reporting and Printing

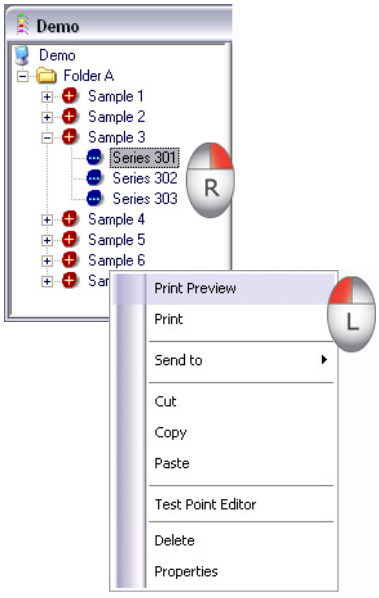
Report Tool

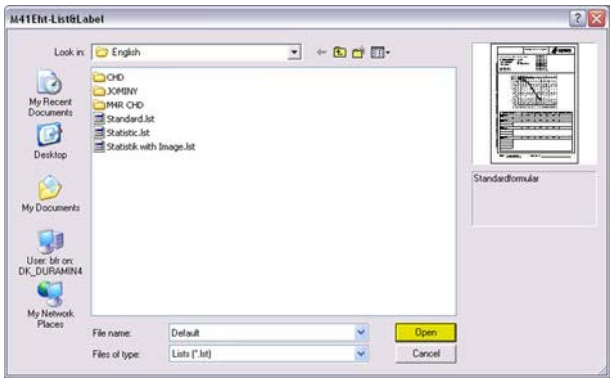
The **ecos** software utilises List&Label® for reporting. A number of predefined report templates are included for immediate use. However, reports can be customised with the built-in List&Label® tools. For more information on List&Label® please go to www.combit.net.

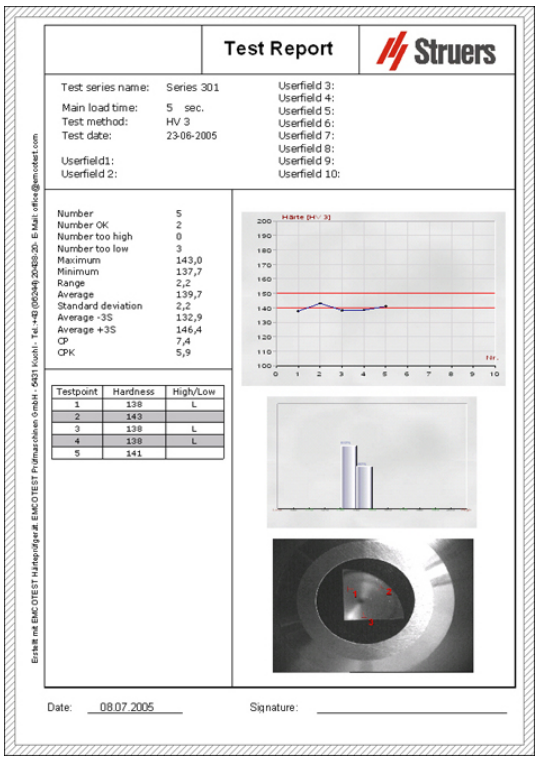
Printing a Series Test Report

To print a test report for a series:

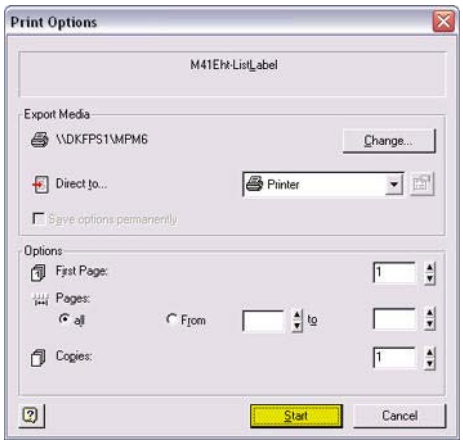
- Select a measurement series.
- Right mouse click and select *Print* or *Print Preview*.
- In the *Print Preview* window, open the *Standard* report template or another relevant template.



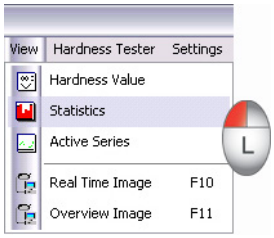




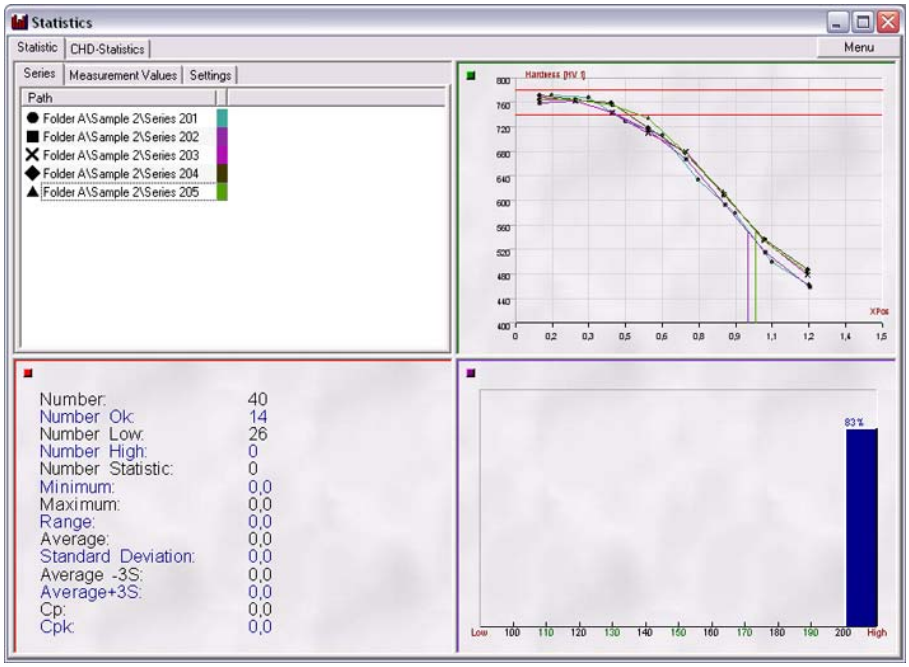
■ Click **Print** to open the *Print Options* window.
■ Click **Start** to print.

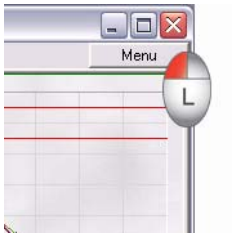


Printing a Sample Test Report

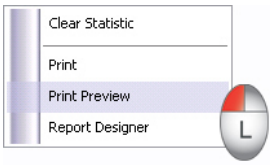


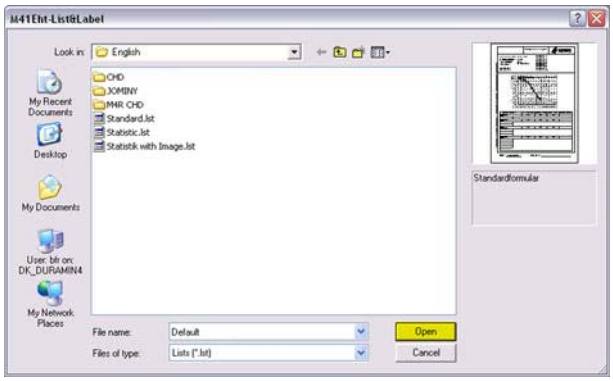
To print a report for a sample e.g. multiple series:
■ Select *View*|*Statistics* to open the *Statistics* window.
■ Drag and drop a sample or individual series into the *Statistics* window.
■ Click the **Menu** button and select *Print* or *Print Preview*.

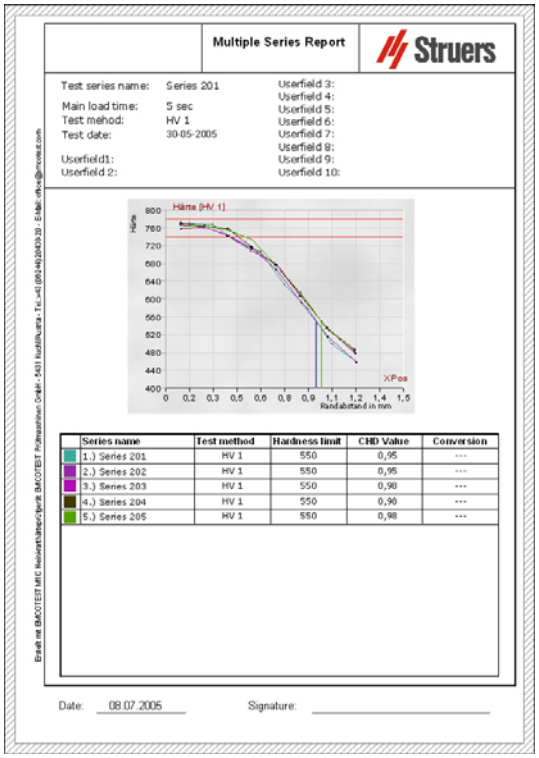


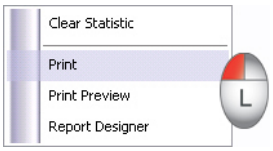


■ In the *Print Preview* window, open the *Multiple Series* report template or another relevant template.






Multiple Series Report
Struers
Test series name: Series 201
Main load time: 5 sec
Test mehod: HV 1
Test date: 30-05-2005
Userfield1:
Userfield 2:
Userfield 3:
Userfield 4:
Userfield 5:
Userfield 6:
Userfield 7:
Userfield 8:
Userfield 9:
Userfield 10:
Härte [HV 1]
XPos
Randabstand in mm
Series name | Test method | Hardness limit | CHD Value | Conversion
1.) Series 201 | HV 1 | 550 | 0,95 | ---
2.) Series 202 | HV 1 | 550 | 0,95 | ---
3.) Series 203 | HV 1 | 550 | 0,98 | ---
4.) Series 204 | HV 1 | 550 | 0,90 | ---
5.) Series 205 | HV 1 | 550 | 0,98 | ---
Date: 08.07.2005
Signature:

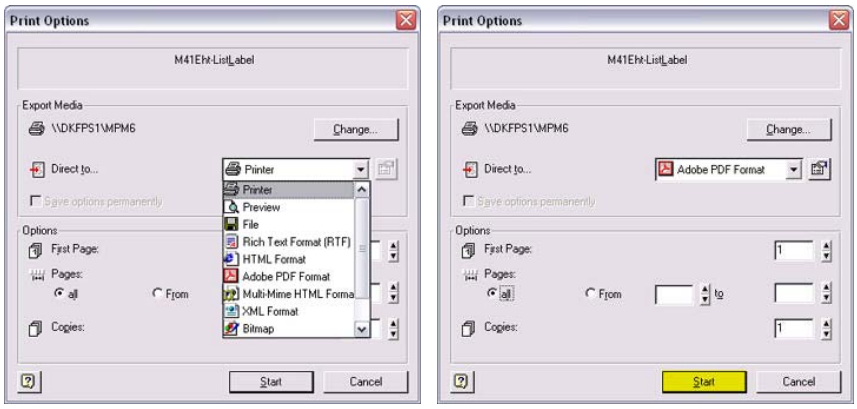


■ Select *Print* to open the *Print Options* window.
■ Click **Start** to print.

Saving Reports in Other Formats

Instead of sending the test report to a printer, other formats can be selected the report saved as a file e.g. a pdf file.
To save reports in another format:

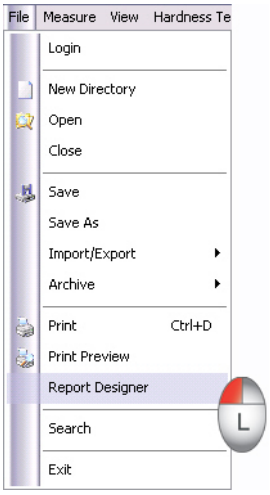
- Repeat the procedure as described above, only select another output media as the printer:

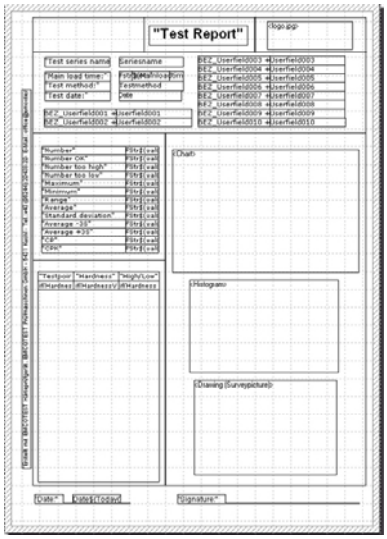


Changing a Report Template

To edit a report template:

- Select *File|Report Designer*.
- Please refer to the List&Label® documentation for further information.





Insert Logo

To insert a company logo on the report templates provided with your hardness tester:

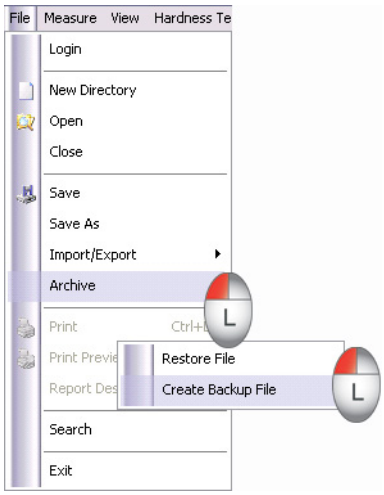
- Use Windows file manager to locate the *Forms* directory.
- Overwrite the graphics file named *logo.jpg* with your logo file.

13. Exporting and Importing of Data

Archive Data

ecos software enables data to be archived for security purposes. In order to minimise the risk of data loss, it is recommended to archive or back-up data onto a separate disc on a regular basis, e.g. on a daily basis.

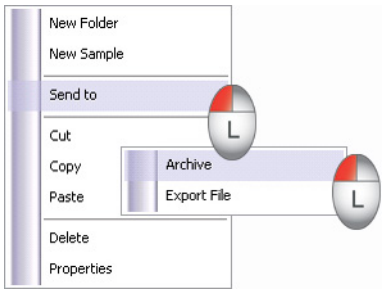
Creating Backup of Directory



To create a complete backup of your directory:

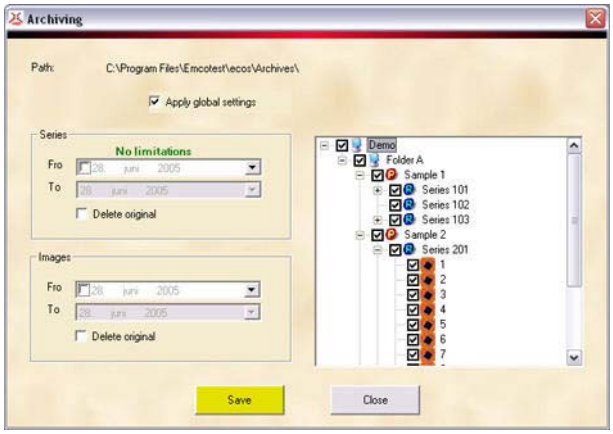
- Select *File|Archive|Create Backup File*.
- Click **Start** to create the backup file.

Archiving Folders, Samples and Series



Data can be archived from anywhere within the directory.
To archive data:

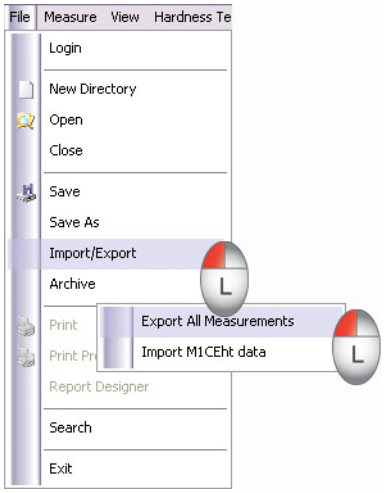
- Select a folder, sample or test series.
  Note: only data from the selected level and downwards in the menu structure can be archived.
- Right click to open the context menu and select *Send to|Archive*. An *Archiving* window opens.
- Tick the samples, series and measurements to be archived.
- If relevant, select date ranges for the series and images to limit the data to be archived.
- Click **Save** to archive.



Exporting Data

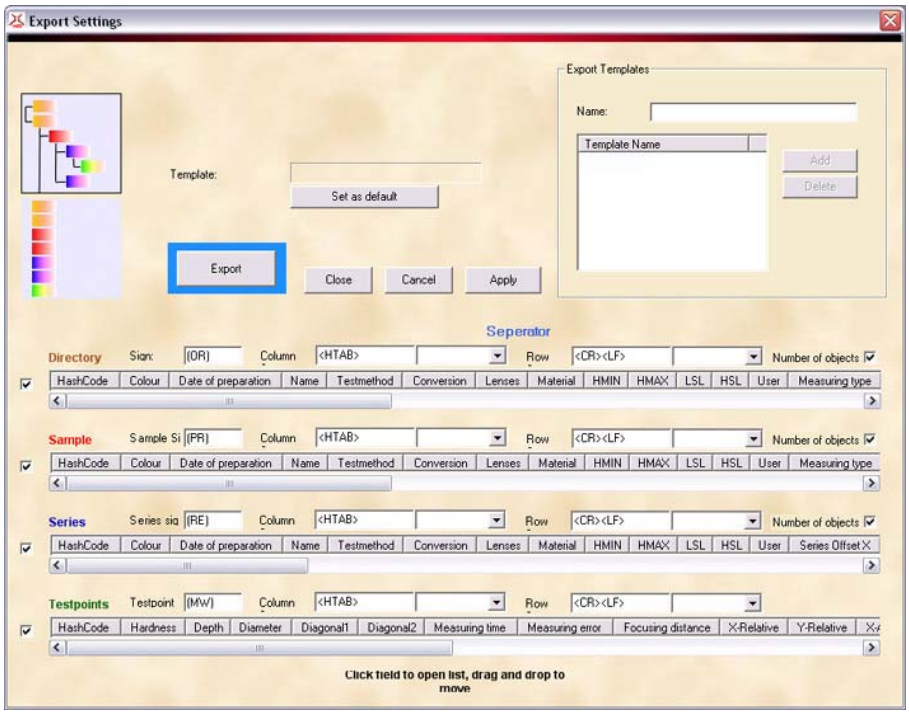
The **ecos** software enables the export of data for processing in other programs.

Exporting the Entire Directory



To export the entire directory:

- Select *File|Import/Export|Export All Measurements*.
- An *Exporting Settings* window opens.

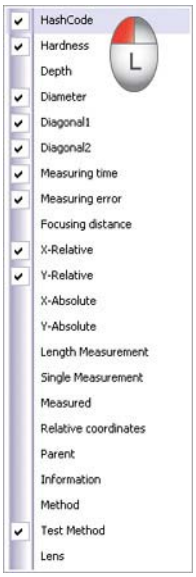


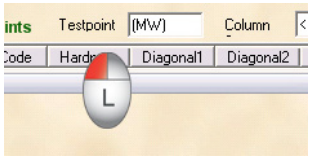
Selecting Fields for Export

The *Export Settings* window contains four rows for *Directory*, *Sample*, *Series* and *Test Points* respectively.

- Tick on the left hand side of each row to select the data to be exported.

- Secondly, click on one of the fields shown for each row to open a list of available fields for exporting.



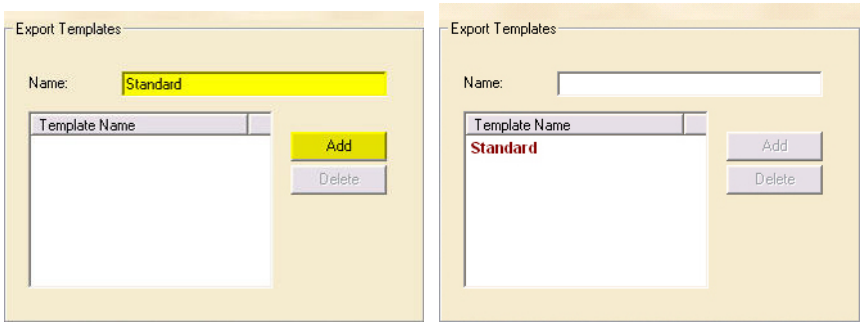


- Tick the fields that are to be included in the export file.
- To alter the order of the fields, simply mouse click and drag to move the fields.
- Identifiers for *Directory*, *Sample*, *Series* and *Test Points* respectively can be entered above the fields and the way in which columns and rows are going to be separated can also be defined.

Saving Export Templates

After selecting the fields to be exported, these settings can be saved for future use.
To save the export settings:

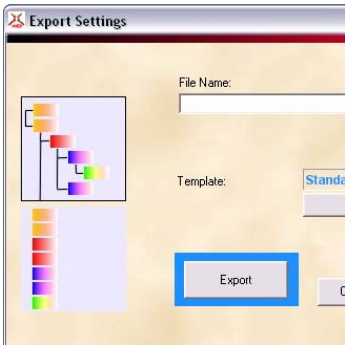
- Enter a name for the template and click **Add**.



Setting a Template as Default

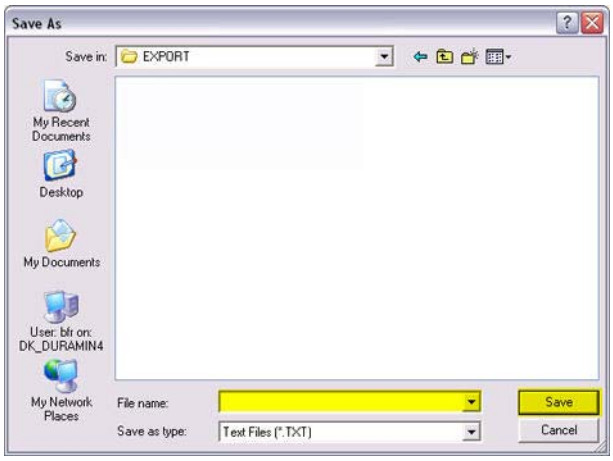
One of the export templates should be chosen as default. This export setting will be used when parts of the directory are exported e.g. a sample or a series.
To set a template as default:

- Select a template and click **Set as default** to set as default.



To export the selected fields for the entire directory:

- Click **Export** to open the dialog window.
- Enter a name for the export file and click **Save**.

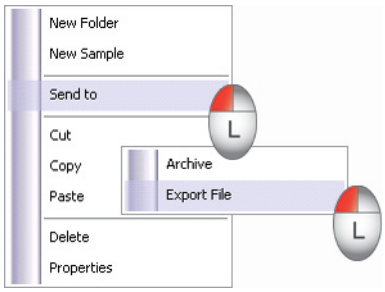


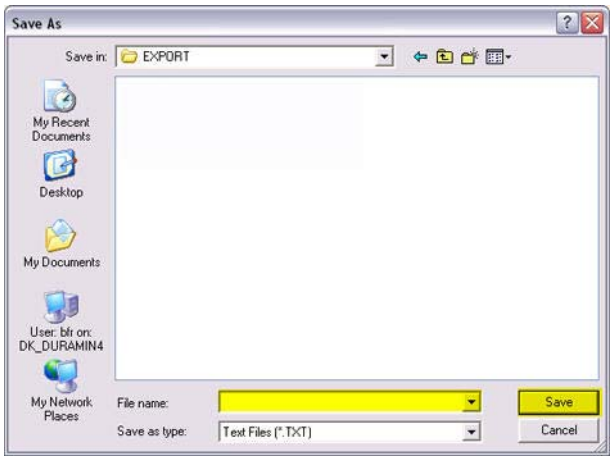
Exporting Folders, Samples and Series

Parts of data from anywhere within the directory can be exported. Only the fields selected in the default export template will be exported.

To export data:

- Select a folder, sample or test series.
  Note: only data from the selected level and downwards in the menu structure can be exported
- Right click to open the context menu and select *Send to|Export file*.
- In the opened Windows dialog box enter a name for the export file and click **Save**.





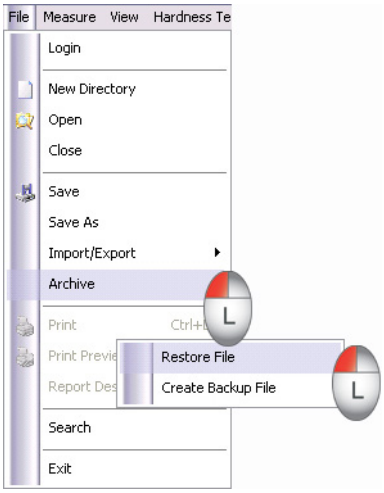
Exporting Series to Excel

Test Series can also be exported directly to Excel.

Importing Data

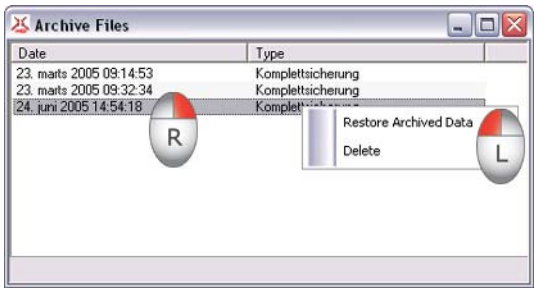
Importing of data may be relevant for restoring archived data or for importing data from another Duramin-A300 database, including databases created on an older Duramin-A300 software platform.

Restoring Archived Data

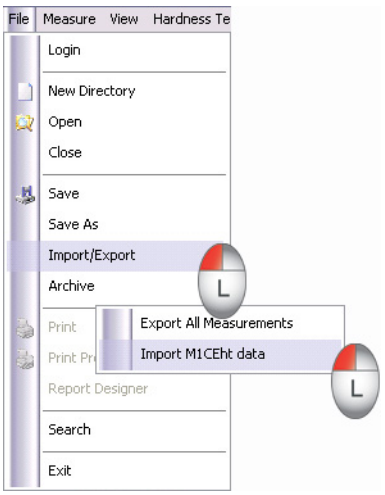


To restore archived data:

- Select *File|Archive|Restore File*.
- Right click the backup file to be restored to open the context menu.
- Select *Restore Archived Data*.

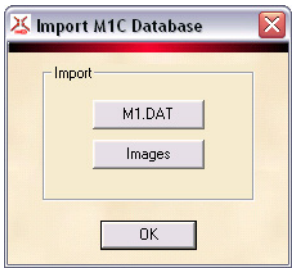


Importing Data from other Duramin-A300 Databases



To import a database:

- Select *File|Import/Export|Import M1CEht data*.
- Click **M1.DAT** to browse for data files.
- Click **Images** to browse for images.
- Click **OK** to import.



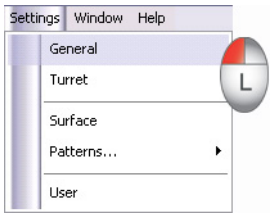
File Locations

The locations of the archive and export files are set under *General Settings.* Please refer to chapter 14 *General Settings*.

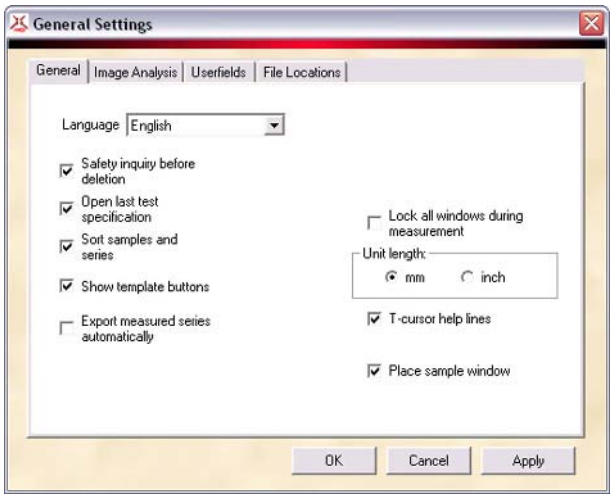
14. General Settings

General Settings

Numerous settings can be edited under *General Settings*.
To open the *General Settings* window:



■ Select *Settings*|*General*.



In the *General* window:

Language

■ Select your preferred language from the **Language** drop down list.

■ Tick **Safety inquiry before deletion** for an **ecos** prompt before deleting data.

■ Tick **Open last test specification** for **ecos** to automatically open the last directory upon start.

Sort Folders, Samples and Series

■ Tick **Sort samples and series** for **ecos** to sort the folders, samples and series alphabetically instead of by creation date.

Shortcut for Template Defined Measuring

■ Tick **Show template buttons** to have the shortcut buttons for the *Template Defined Measuring* included in the toolbar.

■ Tick **Export measured series automatically** for **ecos** to automatically export measurement data to specific folders immediately after measuring.

■ Tick **Lock all windows during measurement** to disable any operation during measuring.

Metric or Inch

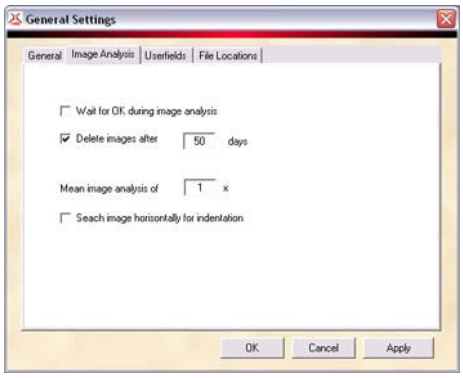
■ Select whether lengths should be displayed in metric or inch.

■ Tick **T-cursor help lines** for the T-cursors to include help lines (for angle adjustment).

■ Tick **Place sample window** for **ecos** to prompt for an OK when placing the sample under the overview camera.

Image Analysis Settings

■ In the *General Settings* window click the **Image Analysis** tab.



■ Tick **Wait for OK during image analysis** for **ecos** to prompt for an OK for the automatic image evaluation before continuing.

■ Tick **Delete images after ___ days** for images to be deleted automatically after a set time. Enter a value to set the days.

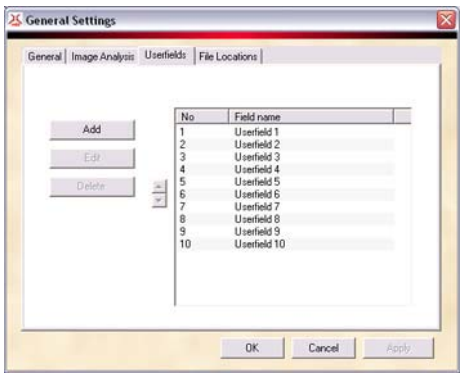
■ Tick **Mean image analysis of ___ x** for **ecos** to perform image analysis several times and display the calculated mean as the result. This is particularly useful for Knoop testing as it reduces statistical noise in the algorithms and thereby improves the accuracy.

■ Tick **Search image horizontally for indentation** for **ecos** to search the entire image on the horizontal pixel line of the crosshair for the indentation.
As default **ecos** only searches along the pixel lines of the cross hair for the indentation. This additional option is useful if the indentations are small but may also prolong the process time.

Userfields Settings

Userfields are fields that can be user defined for entering of specific information on your samples and test series.

■ In the *General Settings* window click the **Userfields** tab.

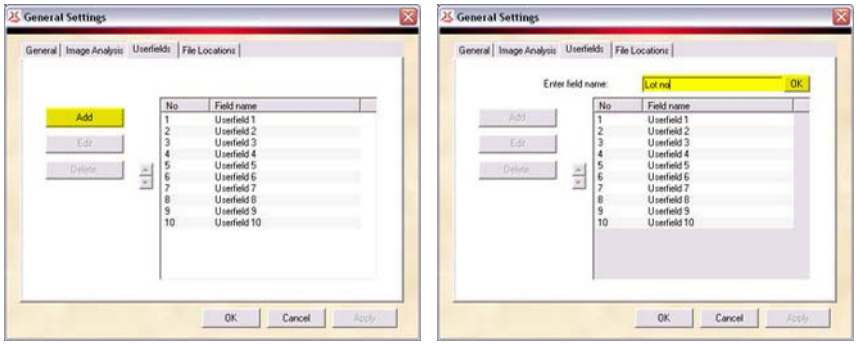


Adding a Userfield

To add a userfield:

■ Click **Add**.

■ Enter a name for the userfield and click **OK**.

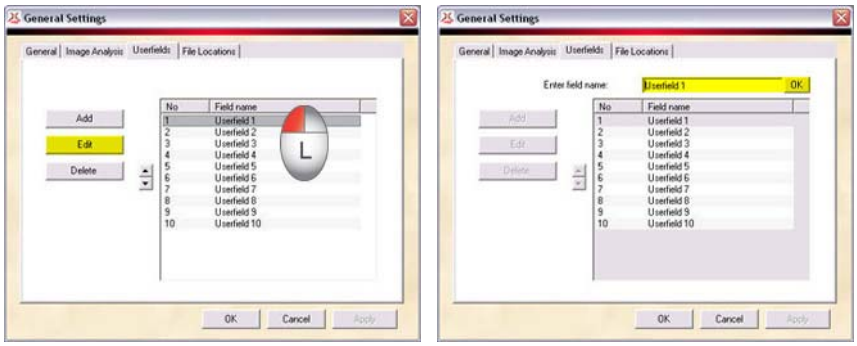


Editing a Userfield

To edit a userfield:

■ Select a userfield and click **Edit**.

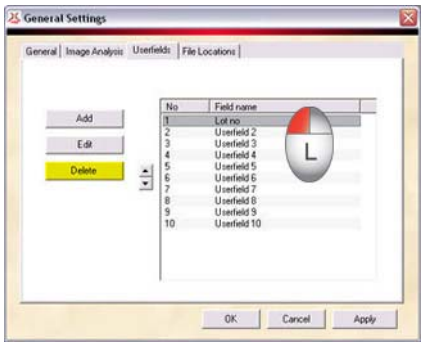
■ Edit the name of the userfield and click **OK**.



Deleting a Userfield

To delete a userfield:

- Select a userfield and click **Delete**.



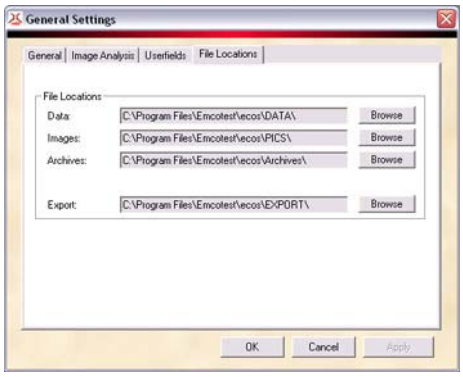
NOTE
Userfields are included in the printing reports.
Reports may need to be modified if userfields are added or deleted.

Changing File Locations

Default folders have been created for the storage of data, images, archive files and export files. The location of these folders can be viewed by clicking the **File Locations** tab in the *General Settings* window.

To select other directories:

- Click **Browse** for each file type and select another destination folder.
- Click **OK** to accept the settings and close the *General Settings* window.



15. Test Methods and Surface Settings

Surface Settings

A surface setting is a combination of:

- A test method
- An objective lens (if it is a method for optical measurement)
- A surface (if it is a method for optical measurement)

Duramin-A300 is supplied with the relevant test methods defined for the combinations of indenters and objective lenses ordered with the tester.
These test methods are calibrated prior to shipping.

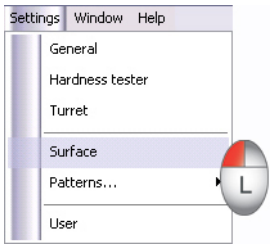
> ***IMPORTANT***
> According to standards, shipping of the hardness tester will necessitate re-calibration.
> Please refer to the next chapter on *Calibration*.

Surfaces

The Surface feature allows test methods to be defined that are optimised for the surface characteristics of your samples e.g. etched, highly reflective or scratched surfaces.

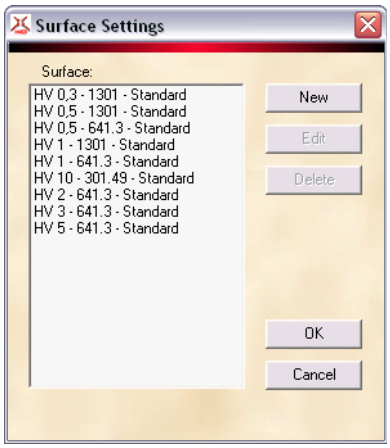
> ***IMPORTANT***
> For calibration purposes a reference test block with matching surface characteristics should be used.

Surface Settings Window



To open the *Surface Settings* window:

■ Select *Settings*|*Surface*.



The *Surface Settings* window lists the defined test methods and the surfaces selected for the methods.

To view the settings for a test method:

■ Mouse click to select a method.

■ Click **Edit** to open the settings for the method.

Deleting a Test Method

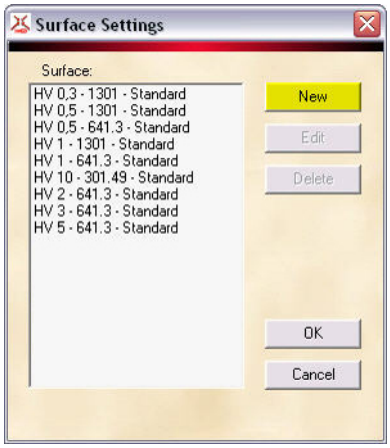
To delete a test method:

- Mouse click to select a method.
- Click **Delete**.
- Click **OK** to close the *Surface Settings* window.

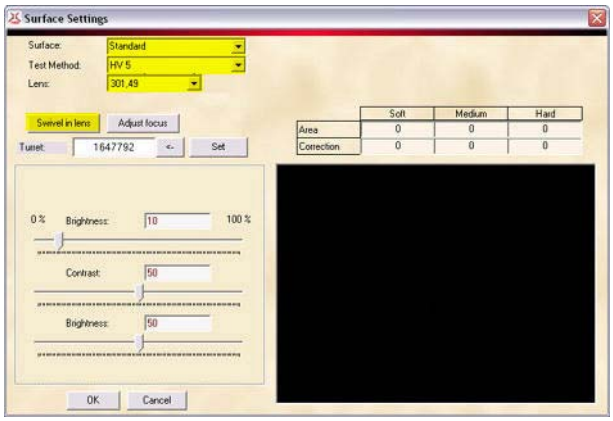
Creating a New Test Method

To create a new test method:

- Click **New** to open the settings for the new method.

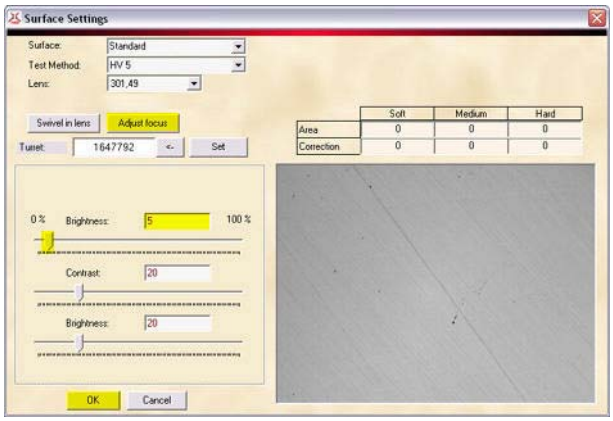


- Select a **Surface** name from the drop down list or enter a new name for the surface characteristic e.g. Standard, Etched, Reflective etc.
- Select a **Test method**.
- Select an objective **Lens**.
- Click **Swivel in lens** to swivel in the selected lens.



- Place a sample on the XY-Stage and raise the stage with the hand wheel until the real-time image is sharp.
- Adjust the **Brightness** of the lens LED to get a real-time image with good lightning.
- Click **Adjust focus** to fine adjust the focussing.

■ Click **OK** to accept and close the *Surface Settings* window.



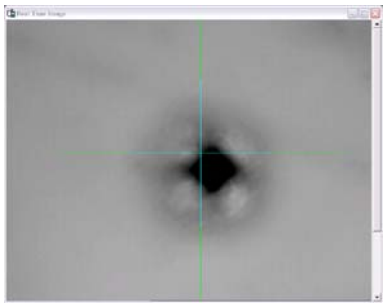
NOTE
The shown values for turret lens positions are only available on hardness testers with automatic turret.

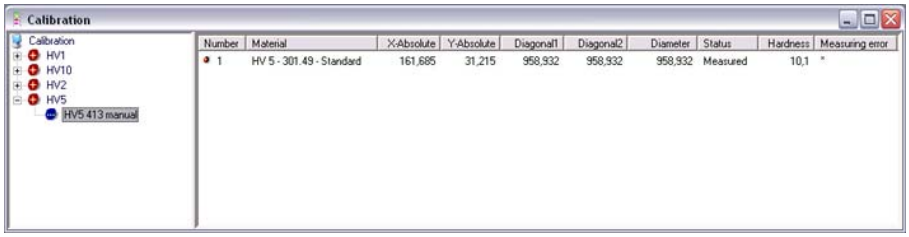
Applying Focussing Distance

To apply the correct focussing distance for the new test method:

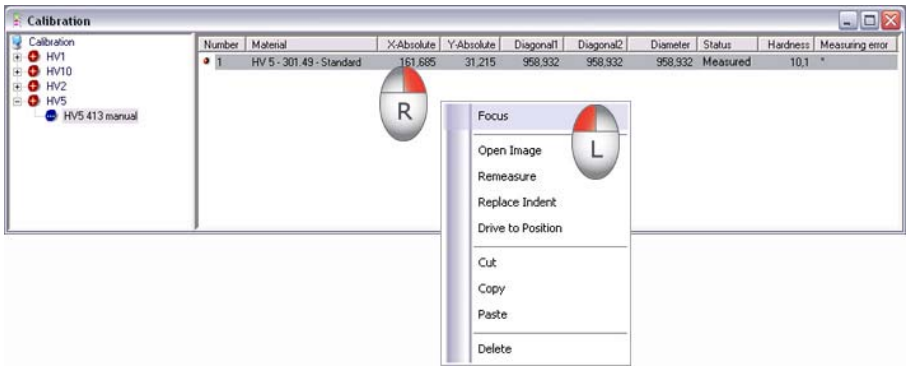
- Create a sample and a series and select the method that has been created.
- Place a sample on the XY-Stage and raise the stage with the hand wheel until the real-time image is sharp.
- If necessary, fine focus on the sample surface.
- Click the **Start Single Measurement** button or press the <F2> key to make a single indentation.

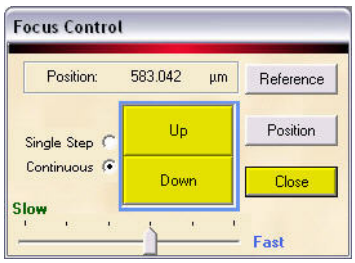
In the *Test Specification* window an evaluation error will be indicated if the real-time image was not in focus.



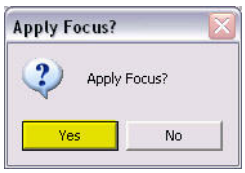


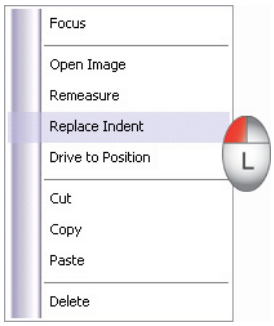
- Right mouse click to open the context menu.
- Select *Focus* to open the *Focus Control* box.



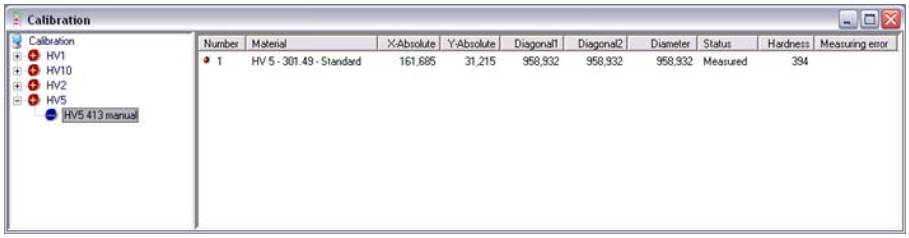


- Click and hold the **Up** or **Down** buttons until the real-time image is in focus.
- If necessary, move the slider between **Slow** and **Fast** to set the focussing speed.
- Click **Close** to close the *Focus Control* box.
- Click **Yes** to apply and save the focus setting.





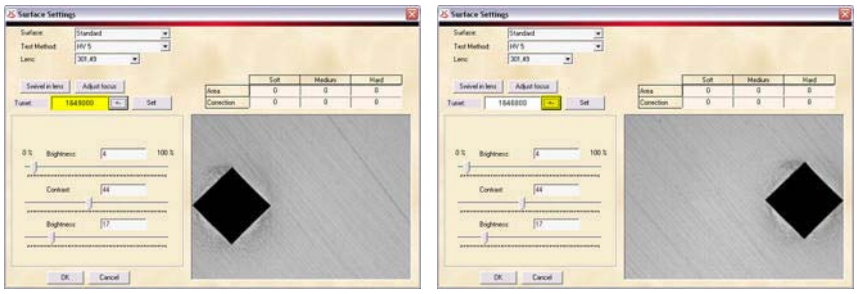
- In the *Test Specification* window right mouse click to open the context menu.
- Select *Replace Indent* and click **Remeasure** to automatically re-measure the indentation.



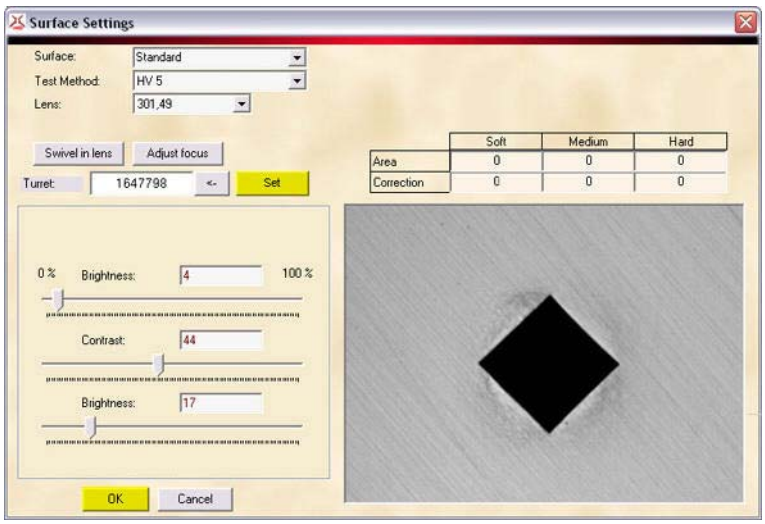
Adjusting the Turret Position

In a test method the lens position in the turret might have to be adjusted. This is relevant if test methods for different indenters e.g. Vickers and Knoop are created using the same objective lens.
To adjust the turret position:

- In the *Surface Settings* window, enter a lens position value and/or click the **<-** button to adjust the lens position.



- Click **Set** to accept the lens position.
- Click **OK** to save the settings with the test method and close the *Surface Settings* window.



NOTE:
When installing two indenters in the turret it is necessary to use an adapter for the second indenter.
As both indenters can be used in combination with the same objective lens, it is necessary to ensure that the indents from both indenters are positioned in the centre of the field of view. Since the field of view of the objective lens only can be adjusted according to one indenter, a Turret Adapter is therefore required to be able to adjust the position of the second indenter.

Calibrating a Test Method

Before performing any tests, the test method created needs to be calibrated.
Please proceed to the next chapter *Calibration*.

16. Calibration

The hardness tester has been calibrated prior to shipment. In general, re-calibration of the tester should only be performed by a trained technician. Therefore only the indirect hardness calibration with test blocks is described in this Instruction Manual. Turret and XY-Stage settings are also shortly described.

User Level

To be able to perform calibration, login at the calibration access level.
To login:

- Select *File|Login*.
- Enter the username **cal** and the password **c1234f** and click **OK**.

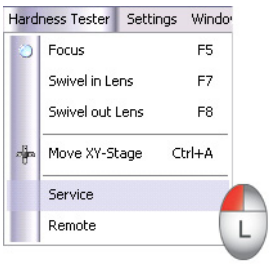
Calibration of Load

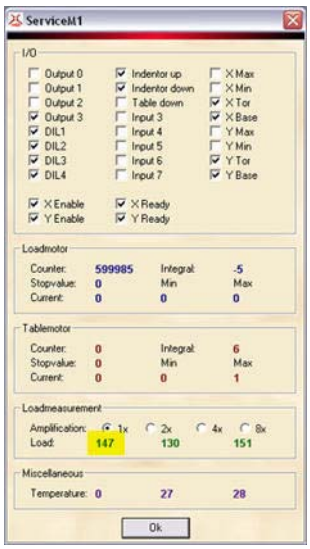
For calibration of the load by means of a digital load meter, please contact a trained technician or a Struers service technician.

Checking the Load Measurement

Occasionally you should check the load measurement:

- Select *Hardness Tester*|*Service*.
- Read the left load measurement value which is a load cell offset. It should have a value of approx. 170.





IMPORTANT
Two objective lenses must be mounted in the swivel head when reading the load measurement values.
If the load cell offset value is <150 or >230, please contact your Struers service technician for examination of the hardware.

Calibration of Lens Magnification Factor

For calibration of the magnification factor of the objective lenses, please contact a trained technician or a Struers service technician.

Indirect Hardness Calibration

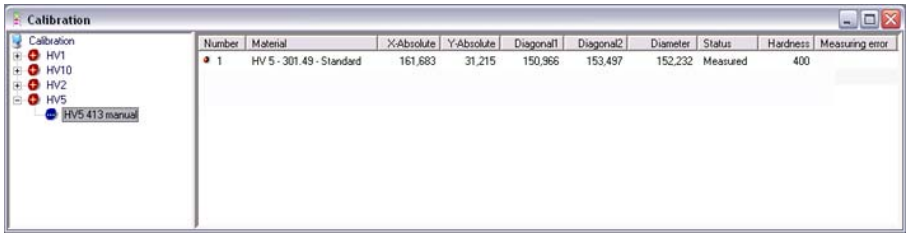
For the indirect hardness calibration certified test blocks are used for reference.
A test method should be calibrated on several test blocks to cover low, medium and high hardness ranges.

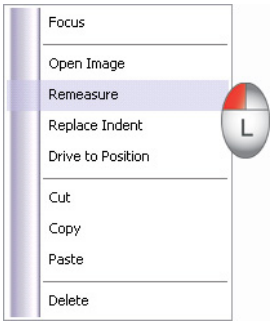
Manual Evaluation

To calibrate a test method:

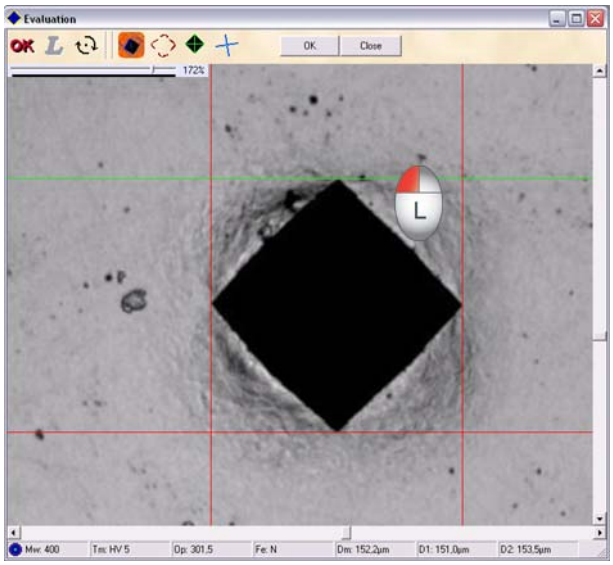
- Create a sample and a series and select the method to be calibrated.
- Place the test block on the XY-Stage and raise the stage with the hand wheel until the real-time image is sharp.
- If necessary, fine focus on the sample surface.
- Click the **Start Single Measurement** button or press the <F2> key to make a single indentation.

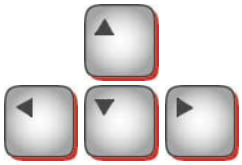
- In the *Test Specification* window, right click the measurement to open the context menu.





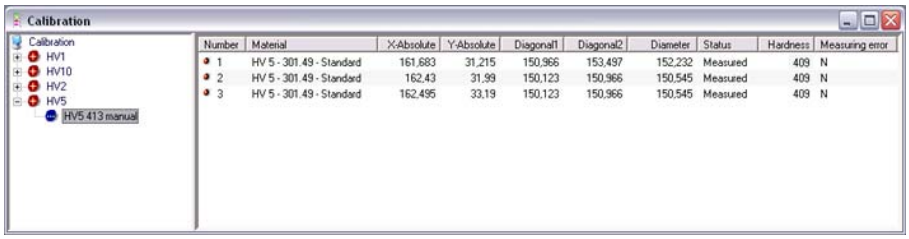
- Select *Remeasure* to open the *Evaluation* window.
- In the opened *Evaluation* window mouse click on a measurement ruler and drag it to the corner of the indentation.
- If necessary move the zoom slider to zoom in on the indentation.





- Press the arrow keys to fine adjust the ruler position.
- Repeat for all for indentation corners.
- Click **OK** to accept the manual measurement.
- Click **OK** to close the *Evaluation* window.

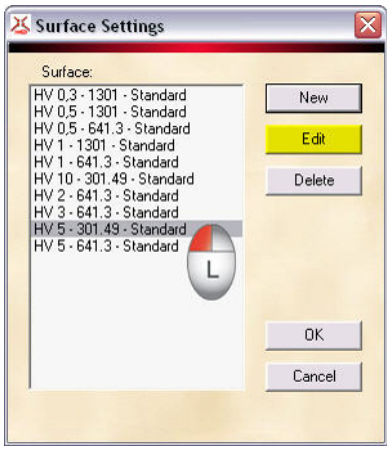
- Repeat to create and manually measure several indentations.



Adjusting Surface Settings

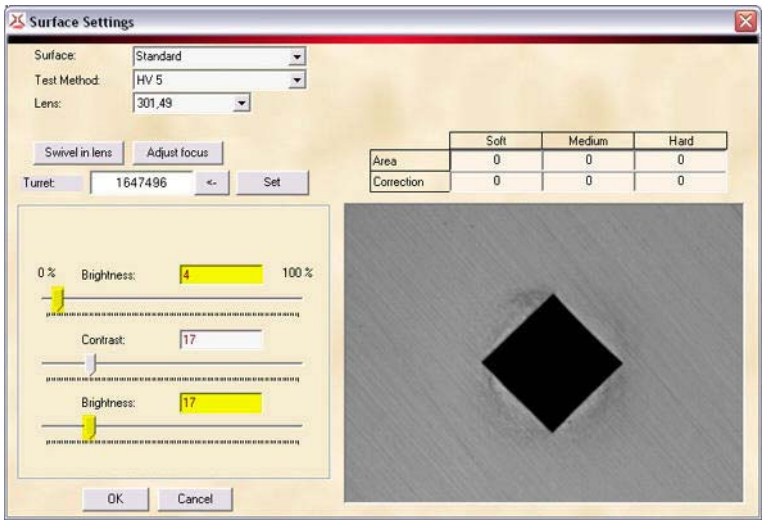
If the measured values are not close to the reference hardness value of the test block:

- Select the measured series and press <Ctrl><m> to open the *Surface Setting* for the test method or select *Settings*|*Surface* and select the relevant test method and click **Edit**.



Adjusting Brightness

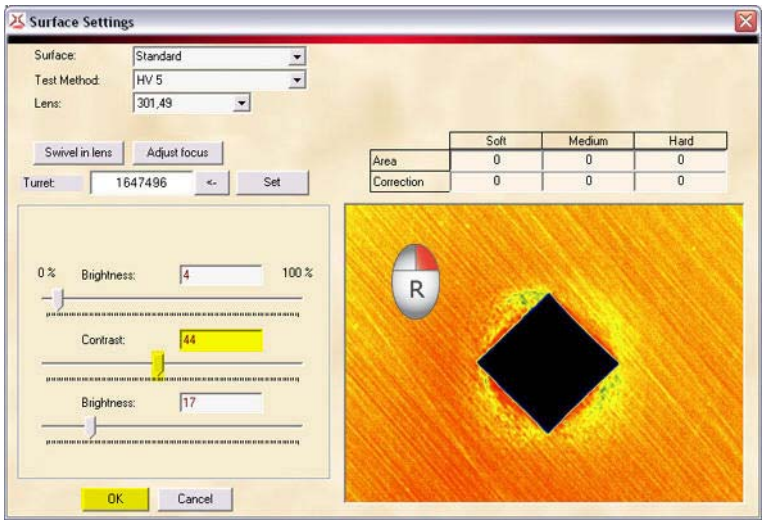
■ In the *Surface Settings* window, adjust the lens brightness and the camera brightness, which will result in different evaluations of the hardness. In general; if the measured hardness is too high, brightness should be decreased, if the measured hardness to too low, brightness should be increased.



HINT
Click on the indentation in the *Surface Settings* window to zoom in on the indentation.

Adjusting the Contrast

- Right click in the image in the *Surface Settings* window to view the image in colours.
- Adjust the camera **Contrast**. The entire indentation should be black. If the indentation edges are lighter e.g. blue, re-adjust the contrast.

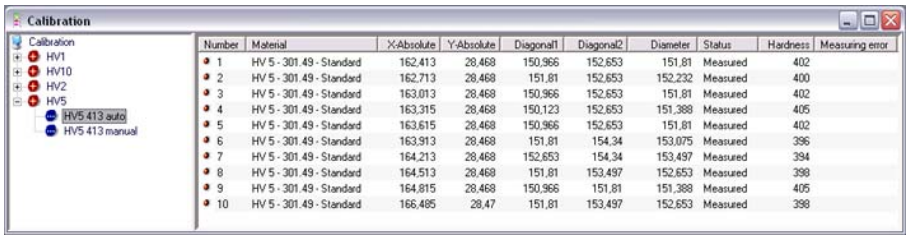


- Click **OK** to save the settings and close the *Surface Settings* window.
- Perform new indentations and measure them manually.
- Repeat the adjustment of the brightness and contrast if necessary until satisfactory measurement values are achieved.

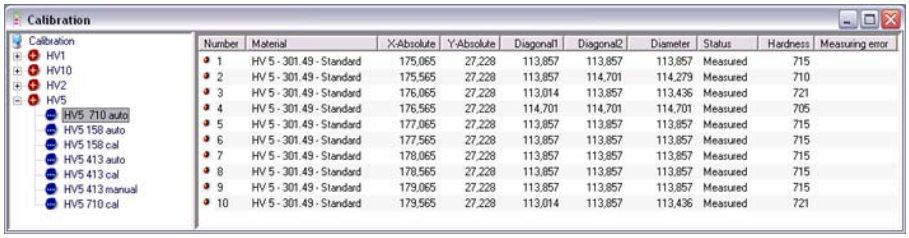
Automatic Measurements

Once the surface settings have been adjusted and valid hardness values achieved, a series of measurements should be performed.
To start measuring:

- Create a series.
- Create test points in the *Test Point Editor*.
- Press the **Series Measurement** button in the tool bar, or press the <F6> function key, or select *Measure*|*Series Measurement* in the menu.
- Click **Start test run** to start measuring.



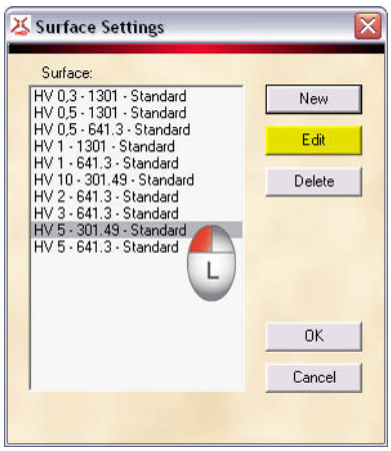
- Repeat the procedure for several test blocks to establish hardness values on low, medium and hard test blocks.



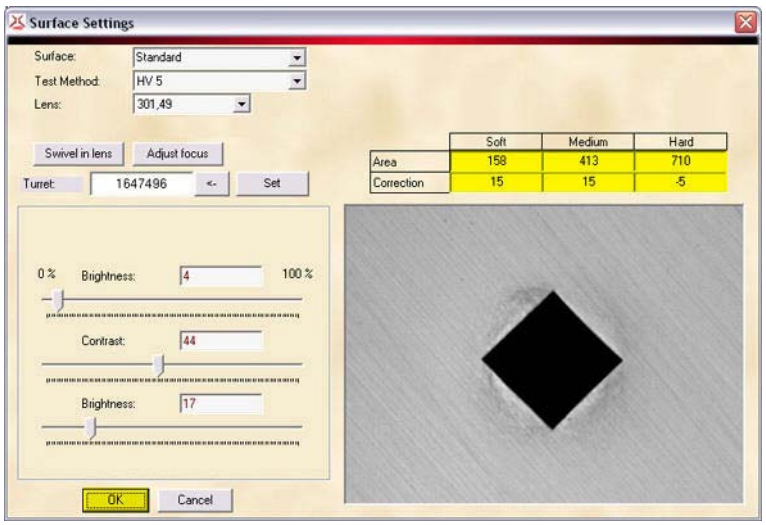
Entering Correction Values

Once automatic measurements have been performed, correction values can be established if the measurement results are not within the allowed tolerance according to the standards.
To enter triple-correction values:

- Select the measured series and press <Ctrl><m> to open the *Surface Setting* for the test method or select *Settings*|*Surface* and select the relevant test method and click **Edit**.



- In the opened *Surface Settings* window enter the correction values for each hardness area.
- Click **OK** to accept and close the *Surface Settings* window.
- Perform new measurement series to validate the triple-correction values.

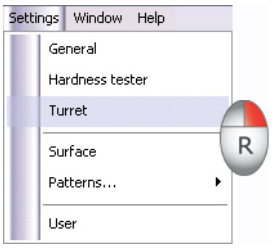


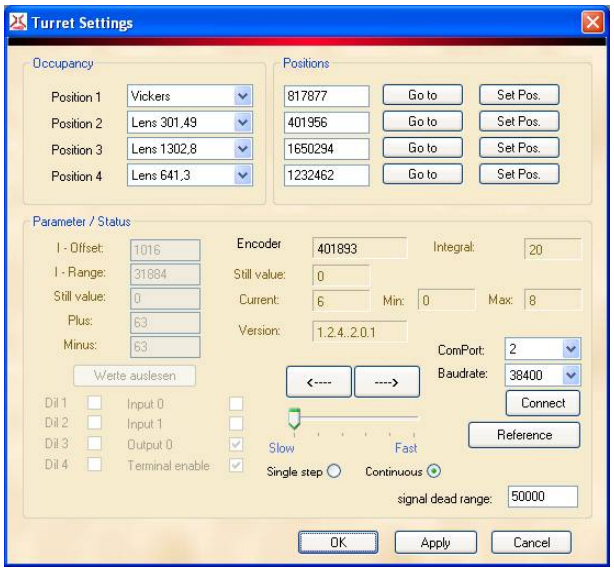
NOTE
The calculated hardness value is only corrected by the triple-correction values when automated evaluation is performed.

Adjusting the Turret Settings

The lens positions in the turret can be adjusted if necessary.
To open the turret settings:

- Select *Settings*|*Turret*.





- If necessary, the position of the individual lenses in the turret can be adjusted by clicking the left and right buttons.

> ***NOTE***
> The lens positions in the turret should be checked approx. once a year.

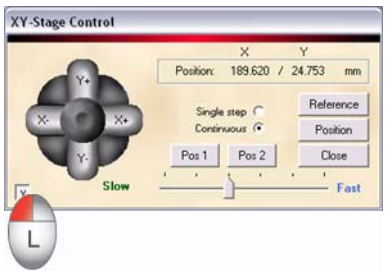
> ***NOTE***
> The default value for the reverse delay compensation for the turret is factory set at 50000 and should not be altered by the operator.

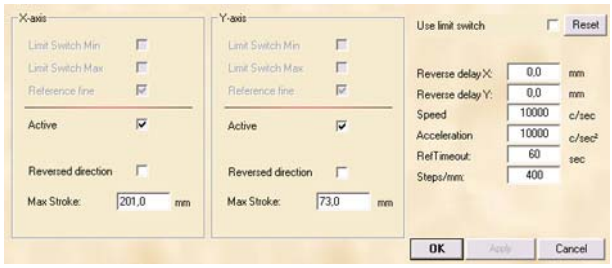
> ***NOTE***:
> Turret Adapter for Additional Indenter,
> please see chapter 15-6

Adjusting the XY-Stage Settings

The XY-Stage settings can be adjusted if necessary.
To open the XY-Stage settings:

- Click the **XY-Stage Control** button on the tool bar, or press the <Ctrl>+<A> keys, or select *Hardness Tester|Move XY-Stage* in the menu.
- The *XY-Stage Control* window opens.
- Click the arrow in the lower left corner to open the *XY-Settings*.





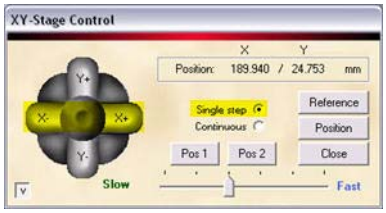
In the settings window, the X-axis or Y-axis can be de-activated if relevant or the stroke can be limited.

IMPORTANT
DO NOT tick Reversed direction for the XY-Stage as this configuration is hardware related. DO NOT alter the Step/mm setting of the XY-Stage

Checking Reverse Delay (backlash) of the XY-Stage

To check whether the XY-Stage moves with any delay when changing direction:

- In the *XY-Stage Control* window select **Single step**.
- Click the j**oystick** to move the XY-Stage in the X direction in steps.
- Note if there is any delay when changing direction e.g. if it is necessary to click more than once before the X position changes.



- If this is the case, note how large the delay is in microns (10 µm in the example shown).
- Enter a correction value for **Reverse delay-X** in the *XY-Settings* window.
- Repeat the procedure for the Y direction.
- Click **Apply** to accept and **OK** to close the settings window.

NOTE
The XY-stage reverse delay (backlash) should be checked approx. once a year.
If the delay exceeds 20µm in model C and D and 50µm in model E, please contact your Struers service technician for examination of the hardware.

Duramin-A300
Accuracy

X- and Y-axis

	Version C and D X-axis	Version C and D Y-axis	Version E X-axis	Version E Y-axis
Stroke [mm]	200 73		335	130
Accuracy * (reproducibility) [mm]	+/- 0,025	+/- 0,025	+/- 0,025	+/- 0,025
Positioning speed [mm/sec]	20 20	20		20
Resolution–single step	0,0025 0,0025	0,0025		0,0025

* Accuracy refers to the whole system. Tolerances of the test unit (indenter/ swivel/ turret) are therefore also considered. Each machine is tested according to a defined testing procedure before delivery. The test data for the individual unit can be found in the report "Procedure" (delivered with the unit).

Overview camera

For approximate positioning of single test points and start points of test point series.

	FOV: 30x40 mm	**FOVmax: 40x50 mm** at 160 mm sample distance	**FOVmax: 54x68 mm** at 190 mm sample distance
Lens 1:4	< 0.2 mm	< 0.2 mm for 80 % of FOV	< 0.2 mm for 80 % of FOV

FOV: Field of view

Note: To achieve the specified positioning accuracy, the sample should be fixed on the sample stage e.g. mounted specimen holder.
The position of the test impression affects the positioning accuracy in series measurement. The position of the test impression is compensated by focussing and storing the new focussing distance.
(See also instruction in chapter 2-6)

Data refer to 23º C ± 5º C ambient temperature

V 1.9 04.09.2008

17. Upgrading the Software

A number of software modules are available for **ecos**. Some of them will also require hardware upgrade. Please contact your Struers sales representative for details.

Software Modules

The ecos software is dongle protected. If the dongle is removed from the PC, **ecos** will be opened in demonstration mode. This will not allow hardness values to be calculated and data cannot be saved. When ordering upgrades, the following information must be stated upon ordering:

- The serial no of your hardness tester
- The current software and firmware version
- The current software code

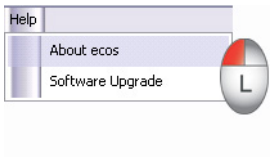
Serial Number

The serial number of your hardness tester is written on the type plate label on the right hand side of your tester.

Software Version

To see the version no of the current ecos software and firmware installed:

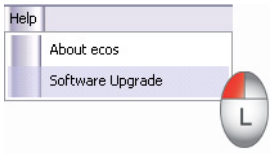
■ Select *Help|About ecos*.



Software Upgrade

To read or enter a software code, open the *Software Upgrade* menu.

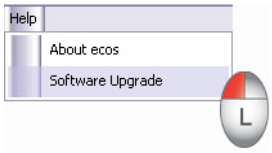
Reading the Current Software Code



To read the current code:

- Select *Help*|*Software Upgrade*.
- A *Software Upgrade* dialog window opens.
- Write down the code and send it to your Struers representative.
- Click **Cancel** to close the *Software Upgrade* window.

Entering an Upgrade Code



To enter an upgrade code:

- Select *Help*|*Software Upgrade*. The *Software Upgrade* dialog box opens.
- Click **OK** to confirm you current software code.
- Enter the upgrade code received from your Struers representative.
- Click **OK** to submit the code and close the dialog box.

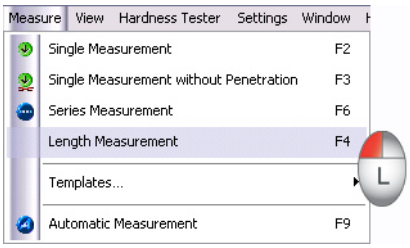
Software Installation

For general installation of the **ecos** software, please refer to the Installation Guide on the **ecos** CD delivered with the hardness tester.

NOTE
Please note that installed software e.g. virus scanners might influence the installation and upgrade procedures.
We therefore recommend that the installation is carried out by authorised IT personnel.

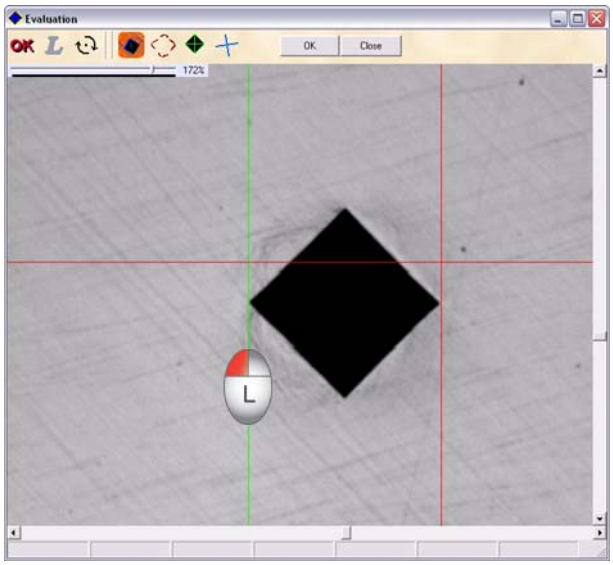
18. Miscellaneous

Performing Length Measurement

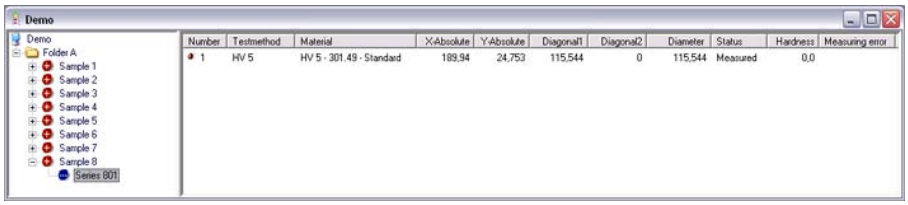


Length measurements can be performed with the **ecos** software.
To measure a length:

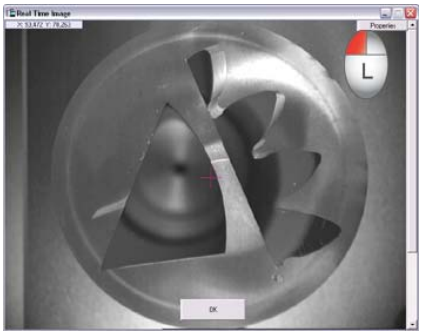
- Select a series.
- Press <F4> or select *Measure*|*Length Measurement* to open the *Evaluation* window.
- Mouse click on the left and right rulers and drag them in place.
- If relevant, use the arrow keys to fine position the rulers.
- Click **OK** to accept the measurement.
- Click **OK** to close the *Evaluation* window.



- The measured length is shown in the *Test Specification* window.

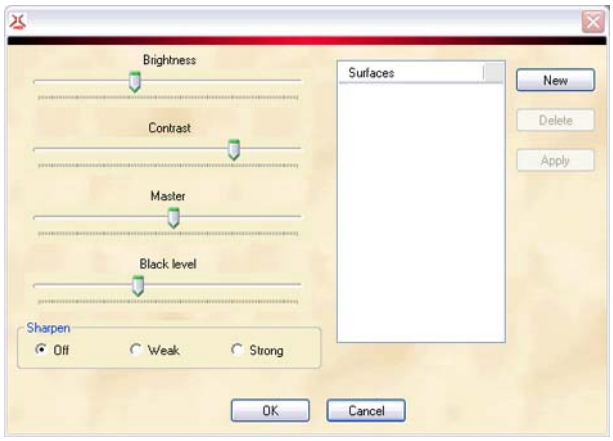


Adjusting Overview Image Settings

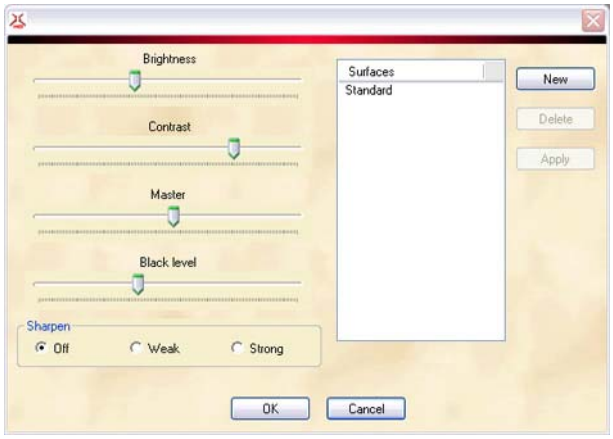


The settings of the overview camera can be adjusted with respect to brightness, contrast, master (amplification) and black level.
To adjust an overview image:

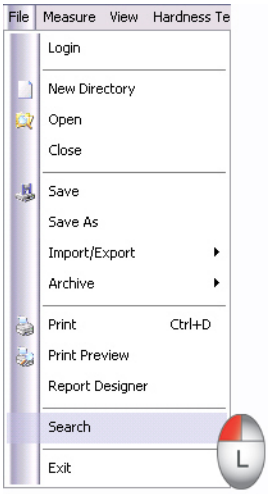
- Click the **Properties** button in the opened overview image.
- Move the sliders to adjust the overview image.



- If relevant, this overview surface setting can be saved.
  - Click **New** and enter a name for the surface.
  - Click **OK** to save the surface.
- Click **OK** to close the Properties window.

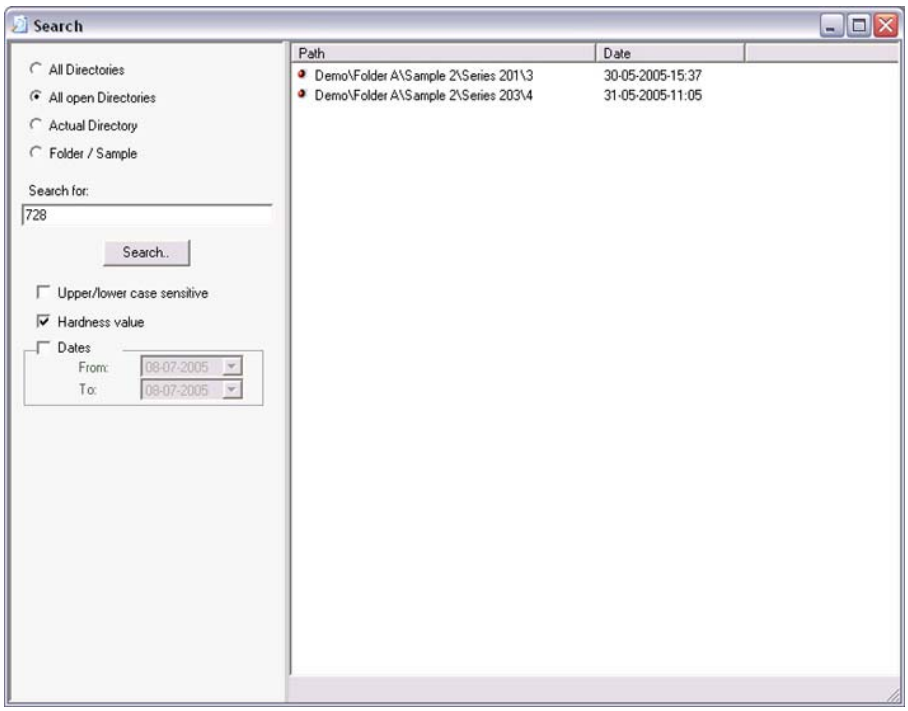


Performing a Search

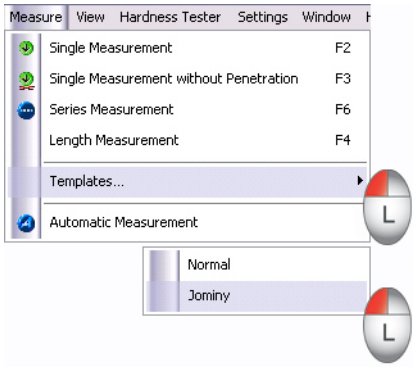


The Search function allows directories, folders, samples and series to be searched.
To search:

- Select *File*|*Search* to open the *Search* window.
- Select the location to search and if relevant limit the search with a creation date range.
- Enter the search criterion and click **Search** to start searching.

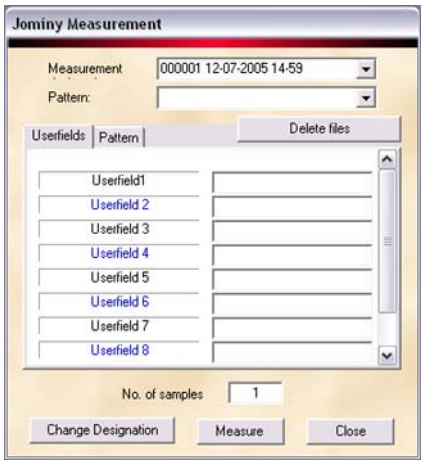


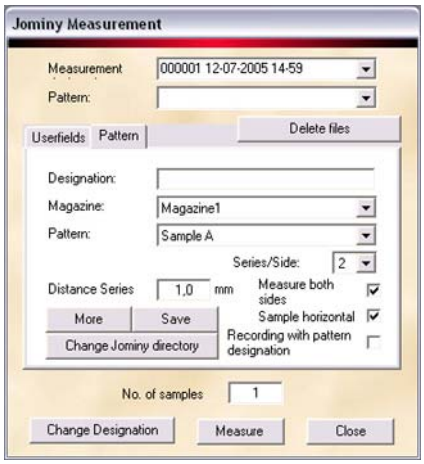
Jominy Testing

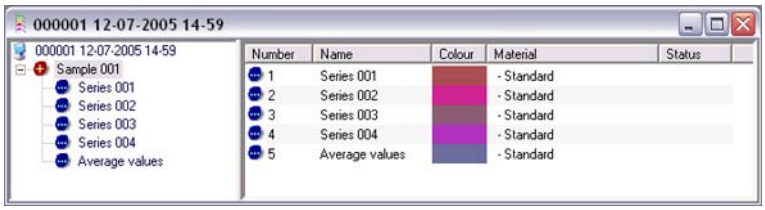


ecos JOMINY is an additional **ecos** module that allows Jominy test according to DIN EN ISO 642. On Duramin-A300 Jominy testing can be performed with HV30 test method.
When **ecos** JOMINY is installed a specific template is available for this testing.
To perform Jominy tests:

- Select *Measure*|*Templates*|*Jominy* to open the *Jominy Measurement* window.
- Select the number of series per side, one- or two-sided testing and orientation of the sample.
- Enter the distance between series and the number of samples to be tested.
- Proceed with the testing as described in chapter 9 *Automatic Measurement using Templates*.
- A directory, samples and series are automatically created including series average values.

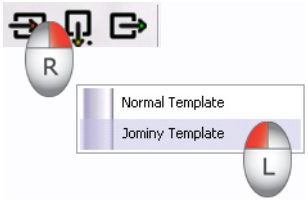






NOTE
For more information on measuring using templates
please return to chapter 9 *Automatic Measuring using Templates*.

Adjusting the Template Tool Button



The shortcut buttons on the toolbar for measuring using templates can be programmed to start either normal templates or the Jominy template when mouse clicked.
To program the buttons:

- Right mouse click on the template buttons.
- Select **Normal Template** or **Jominy Template** to program the button to start this template with a left mouse click.

19. Accessories

Specification	Code
ecos ROCKWELL METHODS	DUROC
ecos MULTIPLE SPECIMENS SOFTWARE	DUSMU
ecos JOMINY	DUSJI
ecos JOMINY MULTIPLE SPECIMENS	DUSMI
PC and TFT monitor, English Windows® Vista Business	DUPCE
PC and TFT monitor, German Windows® Vista Business	DUPCG
Objective Lens, 3×	HOTRI
Objective Lens, 5×	HOFIV
Objective Lens, 10×	HOTEN
Objective Lens, 20×	HOTWE
Objective Lens, 40×	HOFOT
Objective Lens, 80×	HOATI
Vickers diamond indenter ≥ HV0.01 with MPA certificate	HAVIL
Vickers diamond indenter ≥ HV5 with MPA certificate	HAVIH
Knoop diamond indenter with MPA certificate	HAKNE
Rockwell diamond indenter with MPA certificate	HAROC
Rockwell 1/16”carbide ball indenter with MPA certificate	HAROB
Brinell 1 mm carbide ball indenter with MPA certificate	HABON
Brinell 2.5 mm carbide ball indenter with MPA certificate	HABTO
Dust cover	DULCO
Specimen Holder, 30 mm / 1¼" diameter	HAIQU
Specimen Holder, 40 mm / 1½" diameter	HAIAF
Specimen Holder, 50 mm / 2" diameter	HAITO
Specimen Holder, 6 x 30 mm / 1¼" diameter	HAMQU
Specimen Holder, 6 x 40 mm / 1½" diameter	HAMAF
Specimen Holder, 4 x 50 mm / 2" diameter	HAMTO
Clamping device for Jominy testing	HAJOM
Clamping device for Jominy testing, 3-fold	On Request
Turret Adapter for Additional Indenter	DULAT

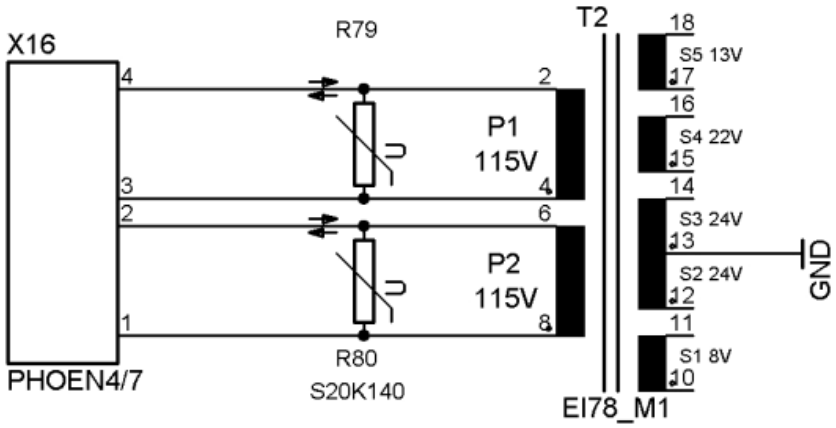
20. Technical Data

Version Specific Data	Version A	Version B	Version C	Version D	Version E
Cross slide / XY-Stage					
Size XY	150×150 mm	150×150 mm	140×200 mm	140×200 mm	505×150 mm
Stroke XY	45×45 mm	25×25 mm	200×73 mm	200×73 mm	335×130 mm
Movement	Manual	Manual	Automatic	Automatic	Automatic
Coordinated input	Manual	Automatic	Automatic	Automatic	Automatic
Overview Camera	No	No	No	Yes	Yes
Field of view	--	--	--	40x50 mm	40x50 mm
Offset between cameras	--	--	--	80 mm	80 mm
Automatic Turret	Optional	Optional	Optional	Optional	Optional
Software					
Vickers evaluation	Automatic	Automatic	Automatic	Automatic	Automatic
Brinell evaluation	Automatic	Automatic	Automatic	Automatic	Automatic
Knoop evaluation	Automatic	Automatic	Automatic	Automatic	Automatic
Rockwell evaluation	Optional	Optional	Optional	Optional	Optional
	Automatic	Automatic	Automatic	Automatic	Automatic
	Not with turret	Not with turret	Not with turret	Not with turret	Not with turret
Case depth evaluation	--	--	Automatic	Automatic	Automatic
Multiple Specimens software	Not possible	Not possible	Optional	Optional	Optional
Jominy Software (HV30)	Not possible	Not possible	Optional	Optional	Optional

Common Technical Data	All versions
Test load range	0.981 N (100 g) to 306.6 N (31.25 Kg)
Evaluation camera Overview camera	½" CMOS, 1,0 LUX, 1280x1024 Pixel (SXGA) ½" CMOS, 1,0 LUX, 1280x1024Pixel(SXGA)
Field of view	160 µm at 40× magnification
Max. sample height	approx. 80 mm
Test anvil height adjustment	Manual
Throat depth	125 mm (max. distance from indenter to machine base)
Power supply	110-230 V / 50-60 Hz
Dimensions H×W×D	720×250×435 mm
Weight (net)	Approx. 35 kg
Conforms with standards	Vickers: DIN EN ISO 6507, ASTM E384, ASTM E92 (HV30), JIS Z 2244. Knoop: DIN EN ISO 4545, ASTM E384, JIS Z 2251. Brinell: DIN EN ISO 6506, ASTM E10 (HBW 2.5-31-25). Superficial Rockwell (option): DIN EN ISO 6508 (HR15N, HR30N, HR15T, HR30T), ASTM E18 (HR15N, HR30N, HR15T, HR30T).

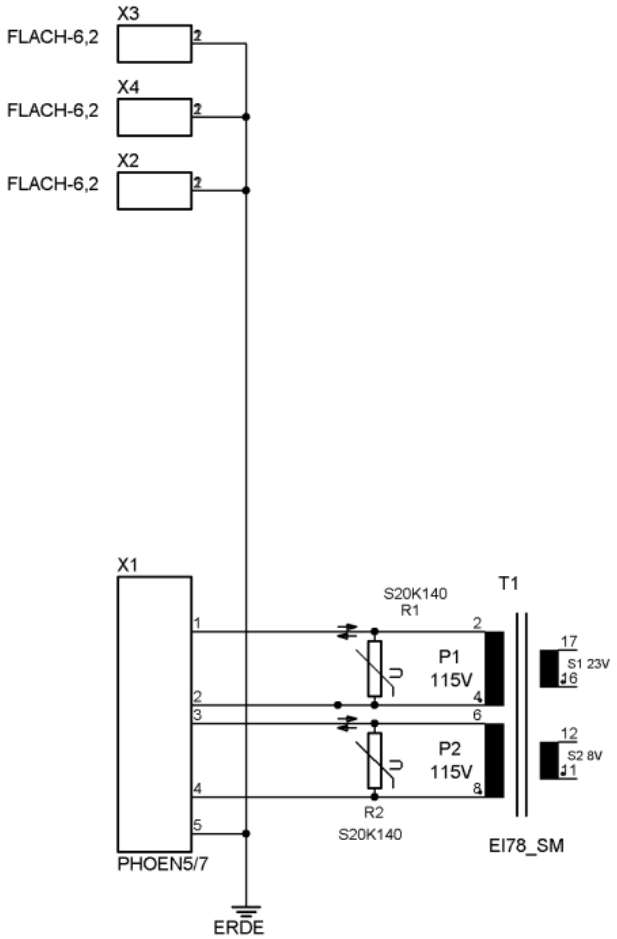
Circuit diagram

Power supply (P285-1)

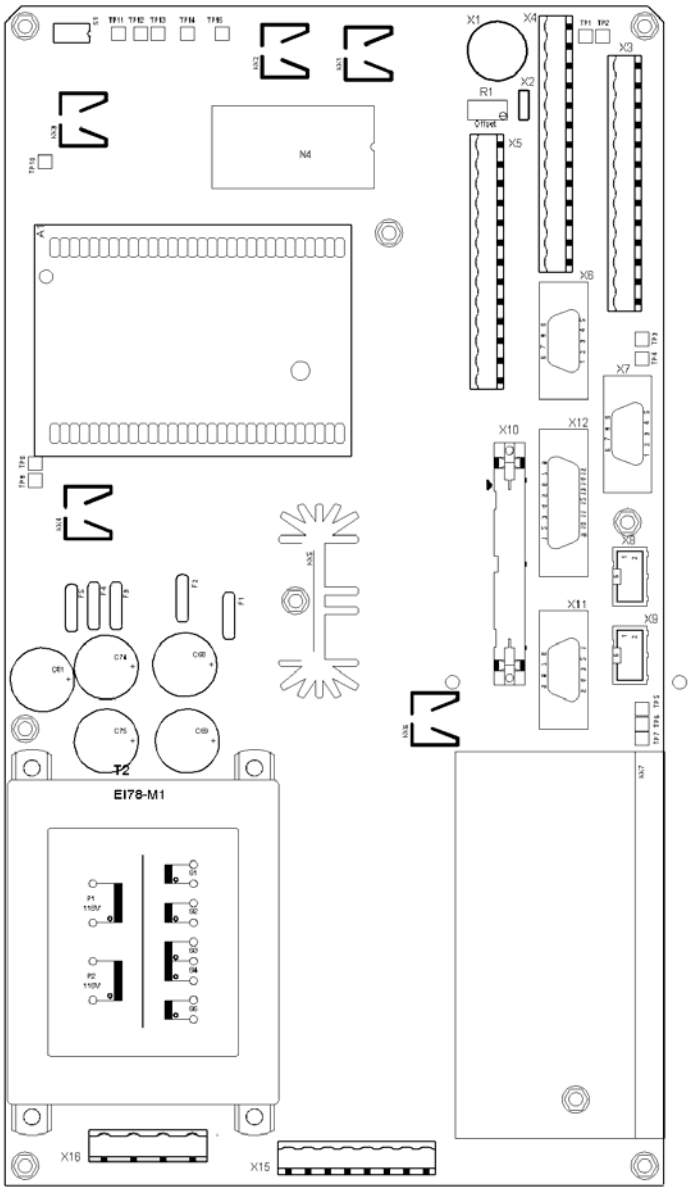


Pecking motor (P285-2)

Only in version C, D and E



CPU



X3

13	GND1
12	+24V
11	RESERVE IN
10	GND1
9	+24V
8	Tisch unten
7	GND1
6	+24V
5	Diamant unten
4	GND1
3	+24V
2	Diamant oben
1	Codierung

X4

13	Codierung
12	GND1
11	+24V
10	RESERVE IN
9	GND1
8	+24V
7	RESERVE IN
6	GND1
5	+24V
4	RESERVE IN
3	GND1
2	+24V
1	RESERVE IN

X5

13	n.b.
12	n.b.
11	n.b.
10	GND1
9	LED OUT
8	n.b.
7	n.b.
6	n.b.
5	n.b.
4	n.b.
3	n.b.
2	n.b.
1	n.b.

X15

8	Tischmotor -
7	Tischmotor +
6	Kraftmotor +
5	Kraftmotor -
4	LED +
3	LED -
2	Optikmotor -
1	Optikmotor +

X16

4	0V
3	115V
2	0V
1	115V

X15:

M1:
1 optic motors + → brown
2 optic motors - →blue

H1:
3 LED - → blue
4 LED + → brown

M2:
5 force motor - → blue
6 force motor + → brown

M3:
7 table motor - → blue
8 table motor + → brown

X3:

S2:
2 base position switch contact → black
3 base position 24V + → brown
4 base position GND → blue

S1:
5 lower end position switch contact → black
6 lower end position 24 V → brown
7 lower end position GND → blue

S3:
8 table limit switch contact → black
9 table limit switch 24V + → brown
10 table limit switch GND → blue

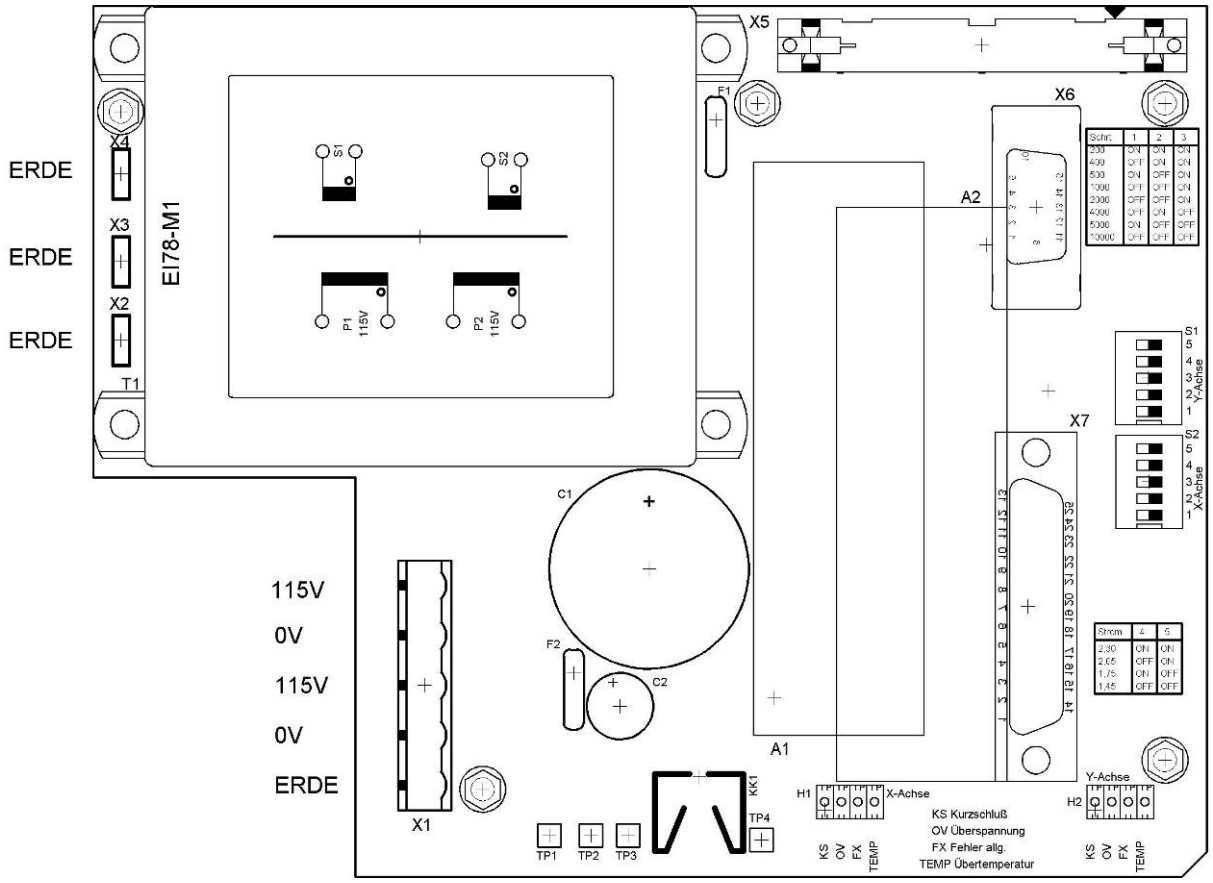
X6: Connection of camera 2

X7: Connection of camera 1

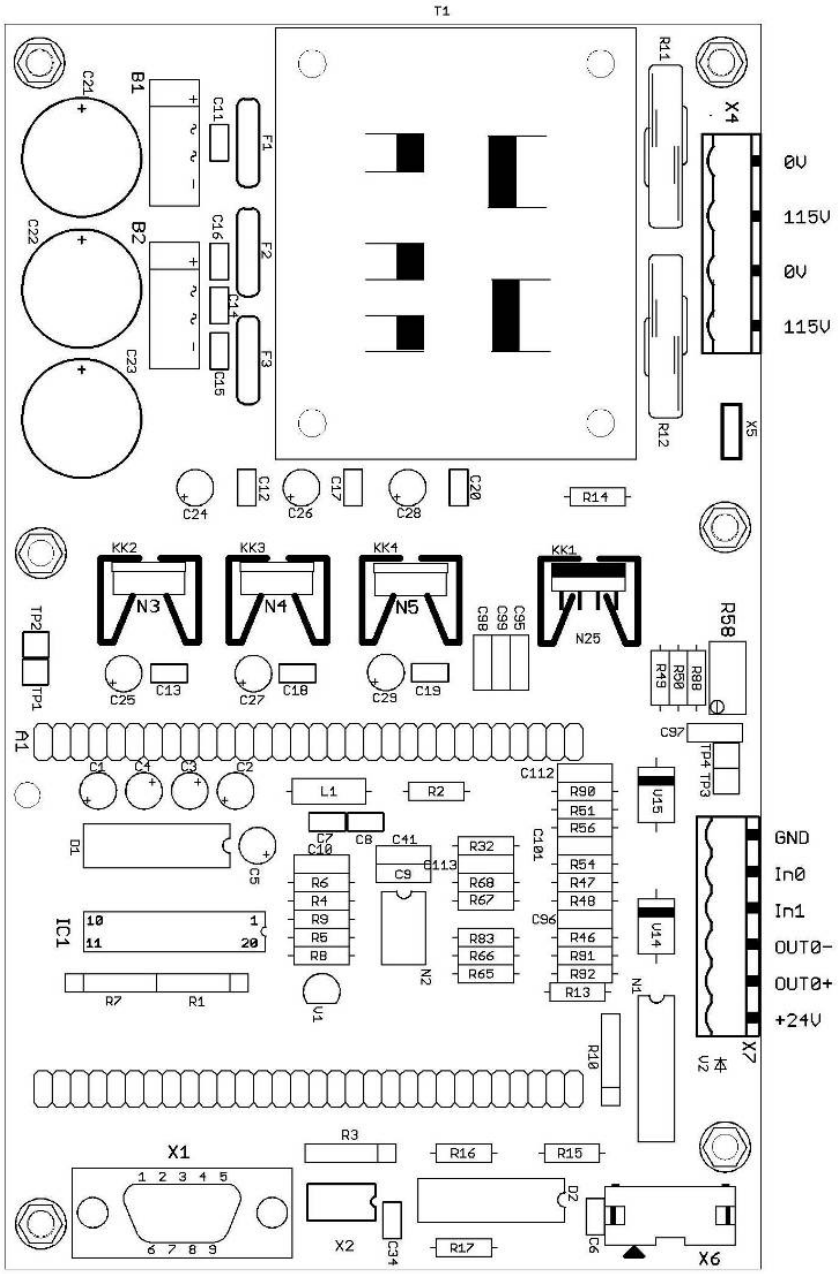
X8: Table motor encoder connection

X9: Force motor encoder connection

Stepmotor card

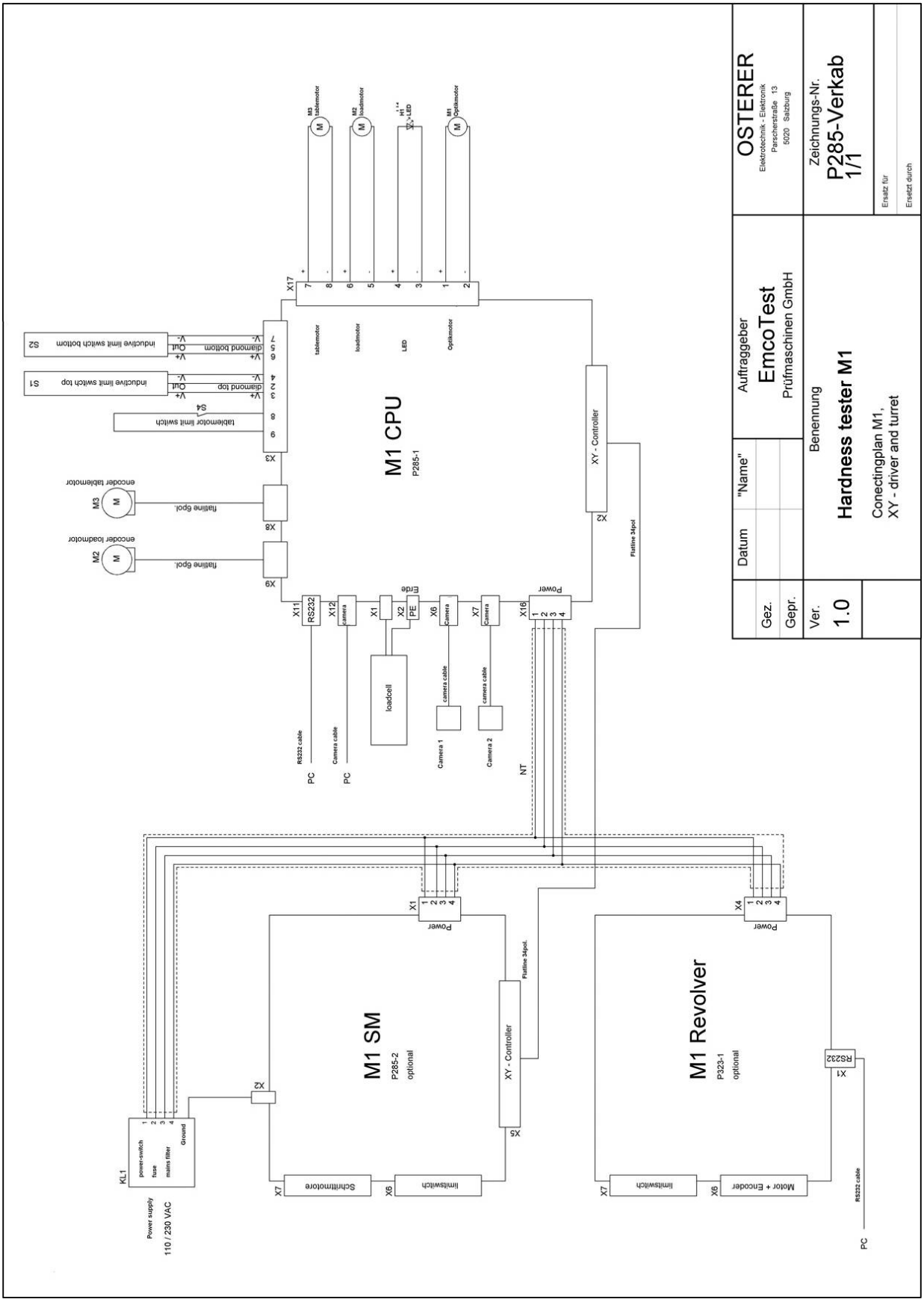


Turret card



X7:

S4:
1 Revolver position 24V➔ brown
4 Revolver position switch cont.➔Black
6 Revolver position GND ➔ blue


OSTERER
Elektrotechnik - Elektronik
Parscherstraße 13
5020 Salzburg
Zeichnungs-Nr.
P285-Verkab
1/1
Ersatz für
Ersetzt durch
Auftraggeber
EmcoTest
Prüfmaschinen GmbH
Benennung
Hardness tester M1
Conectingplan M1,
XY - driver and turret
Datum
"Name"
Gez.
Gepr.
Ver.
1.0
M1 CPU
P285-1
M1 SM
P285-2
optional
M1 Revolver
P323-1
optional
XY - Controller
Flatline 34pol.
Power
RS232
camera
PE
Erde
loadcell
camera cable
RS232 cable
Camera cable
Camera 1
Camera 2
NT
PC
tablemotor
loadmotor
LED
Optikmotor
inductive limit switch bottom
inductive limit switch top
diamond bottom
diamond top
tablemotor limit switch
encoder tablemotor
encoder loadmotor
flatline 6pol.
power-switch
fuse
mains filter
Ground
KL1
Power supply
110 / 230 VAC
Schrittmotore
limitswitch
Motor + Encoder